Mines and Minerals Division

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Geology of the Clearwater Bay Area, District of Kenora

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Open File Report 5684

Geology of the Clearwater Bay Area, District of Kenora

by

J.A. Ayer

1988

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Foreword

Prior to 1986 the geological information available for the Clearwater Bay Area, District of Kenora was at a reconnaisance and preliminary level. The detailed mapping project described in this geological report is essential for effective mineral exploration and proper land use potential evaluation.

The area hosts several gold occurrences and porphyry-type copper-molybdenum-zinc mineralization.

The mapping project is one component of the Canada-Ontario Mineral Development Agreement (COMDA), which is a subsidiary agreement to the Economic Development Agreement (ERDA) signed by the governments of Canada and the Province of Ontario. The Clearwater Bay project is one of several projects funded within the COMDA agreement and targetted on the Lake of the Woods area, an area considered to have an excellent potential for discovery of gold and base metals.

V.G. Milne
Director
Ontario Geological Survey

CONTENTS

ABSTRACT: xxv

INTRODUCTION: 2

Location and Access 2
Present Geological Survey 2
Previous Geological Work 2
Mineral Exploration 3
Physiography 4
Acknowledgements 5

GENERAL GEOLOGY: 5

Archean 8

Metavolcanic and Metasedimentary Rocks 8
Mafic Metavolcanic Rocks (Unit 1) 8
Lower Mafic Unit 8
Upper Mixed Unit 9
Petrography 10
Interpretation 12

Intermediate Metavolcanic Rocks (Unit 2) 12
Flows 12
Debris Flows 13
Petrography 14
Interpretation 16

Felsic Metavolcanic Rocks (Unit 3) 16

Petrography 18

Interpretation 19

Metasedimentary Rocks (Unit 4) 20

Petrography 22

Interpretation 22

Metamorphosed Ultramafic and Mafic Intrusive Rocks (Units 5 & 6) 23

Petrography 24

Metamorphosed Felsic to Intermediate Intrusive Rocks (Unit 7) 25

White Partridge Bay Group Metasedimentary Rocks (Unit 8).....26

Interpretation 27

Pretectonic to Syntectonic Felsic to Intermediate Intrusive Rocks (Unit 9) 28

Winnipeg River Subprovince 28

Winnetka Lake Stock 29

Ridge Lake Stock.....30

Granite Lake Stock.....31

Syntectonic to Late Tectonic Felsic Intrusive Rocks (Unit 10) 32

Rush Bay Stock 32

Canoe Lake Stock 33

Mafic Intrusive Rocks (Unit 11).....35
Proterozoic 35

Mafic Intrusive Rocks (Unit 12).....35
Phanerozoic 37
Cenozoic.....37
Quaternary.....37
Pleistocene 37
Recent 38

AEROMAGNETIC DATA:.....38

PETROCHEMISTRY:.....39
Introduction 39
Volcanic Geochemistry 40
Lower Mafic Unit 40
Upper Mixed Unit 41
Synvolcanic Intrusions 43

METAMORPHISM: 43

STRUCTURAL GEOLOGY 44
Introduction 45
Folding 46
Ductile Deformation 48
Faulting 49

Economic Geology: 51
Introduction 51

Gold 51

Copper-Molybdenum-Zinc 53

Sampling by the Field Party 54

Description of Properties 54

Argyle Occurrence (No. 1) 55

Echo Bay Occurrence (No. 2) 57

Echola Occurrence (No. 3) 59

Falconbridge Limited Property (No. 4) 59

Ash Bay Occurrence 60

Geroux Occurrence (No. 5).....61

Homestake Mineral Development Company Property (No. 6)....63

Rush Bay Occurrence 63

Homestead Occurrence 64

Hudson Bay Exploration and Development Company Limited
[1975] (No. 7).....65

Inglis Lake Occurrence (No. 8)....65

Kerr Addison Mines Limited [1971] (No. 9) 67

Manitoba Consolidated Occurrence (No. 10) 68

Noranda Exploration Company Limited Property (No. 11)....69

Nonesuch Occurrence 69

Gauthier Occurrence 70

Ogawa Bay Occurrence 72

Pogson, G. Property (Three Friends Occurrence) (No. 12)...73

Rapski, J.P. Property (No. 13) 76

Selco Exploration Company Limited [1966] (No. 14)...76

Squaw Lake Occurrence (No. 15).....77

Victoria Island Occurrences (No. 16).....78

Whiting Property (Unicorn Occurrence) (No. 17).....80

Recommendations for Future Exploration 82

REFERENCES 85

FIGURES

1. Key map for the Clearwater Bay area. xxiv
2. Generalized lithostratigraphic and structural map of the Clearwater Bay area. 97
3. Sketch of Ignimbrite outcrop on the east side of Zigzag Island. 98
4. Sample Locations for Analysed Rocks from the Clearwater Bay Area. 99
5. $Na_2O + K_2O$ Versus SiO_2 Diagram of analyses of Volcanic and Synvolcanic Intrusive Rocks from the Clearwater Bay Area. 100
6. AFM Diagram of Volcanic and Synvolcanic Intrusive Rocks from the Clearwater Bay Area. 101
7. Jensen Cation Diagram of Volcanic and Synvolcanic Intrusive Rocks from the Clearwater Bay Area. ...102
8. Chondrite Plot of REE for Lower Mafic Unit Volcanics from the Clearwater Bay Area. 103
9. Chondrite Plot of REE for Upper Mixed Unit Mafic Volcanics from the Clearwater Bay Area. 104
10. Chondrite Plot of REE for Upper Mixed Unit Intermediate Volcanics from the Clearwater Bay Area. ...105
11. Chondrite Plot of REE from the Upper Mixed Unit Felsic Ignimbrite Horizon on Zigzag Island. 106
12. Chondrite Plot of REE for Felsic Volcanics from the Rat Portage Bay Area. 107
13. Chondrite Plot of REE for Synvolcanic Intrusions from the Clearwater Bay Area. 108

14. Echo Bay Occurrence. 109

15. Falconbridge Limited (Ash Bay Occurrence). 110

16. Inglis Lake Occurrence. 111

17. Noranda Exploration Company Limited (Gauthier Occurrence). 112

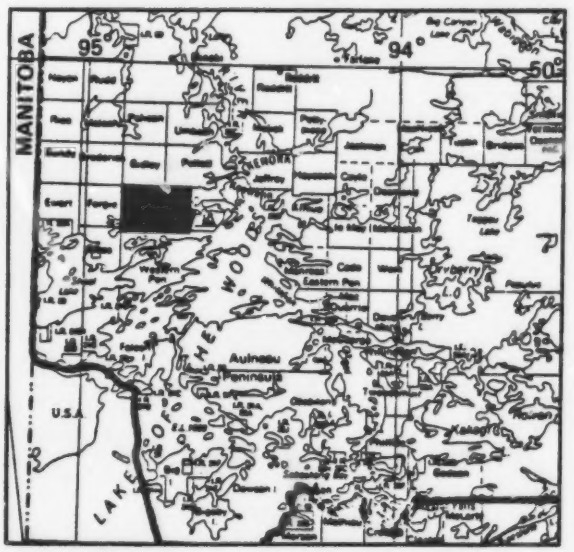
18. Pogson, G. Property (Three Friends Occurrence)....113

TABLES

		page #
1.	Lithological units of the Clearwater Bay area.	115
2.	Modal Mineralogy of Pretectonic to Syntectonic Felsic to Intermediate Intrusive Rocks (Unit 9).	118
3.	Modal Mineralogy of Syntectonic to Late Tectonic Felsic Intrusive Rocks (Unit 10).	119
4.	Chemical Analyses of Samples from the Clearwater Bay Area.	120
5.	Description of Analyzed Samples from the Clearwater Bay Area.	126
6.	Grab Sample Assay Values for Samples Collected during the 1986 field season.	128
7.	Grab Sample Assays - Inglis Lake Occurrence.	132
8.	Grab Sample Assays - Pogson Property (Three Friends Occurrence).	133

PHOTOGRAPHS

	page #
1. Photomicrograph of quench - textured basalt.	135
2. Intermediate banded flow.	136
3. Intermediate pillowed and amygdaloidal flow.	137
4. Intermediate pillow breccia.	138
5. Close-up of Photo 4.	139
6. Intermediate debris flow.	140
7. Bedded intermediate debris flows.	141
8. Massive columnar jointed felsic volcanic.	142
9. Thinly bedded felsic ignimbrite.	143
10. Photomicrograph of felsic ignimbrite tuff breccia.	144
11. Siltstones and wackes cut by mafic dike.	145
12. Chert-argillite ironstone.	146
13. Turbidites interbedded with conglomerate.	147
14. Photomicrograph of rapikivi-textured porphyry.	148
15. Lampyrophyre dike with rounded inclusions.	149



LOCATION MAP

Scale : 1:1 584 000 or
1 inch to 25 miles

Figure 1. Key map for the Clearwater Bay Area.

ABSTRACT:

The Clearwater Bay Area is in the northwestern part of Lake of the Woods about 20 km southwest of Kenora and covers approximately 220 km^2.

All rocks are of Archean age with the exception of a northwest trending Proterozoic diabase dike.

The supracrustal rocks are within the Wabigoon Subprovince and consist of easterly trending metavolcanics and metasediments. They have been subdivided into three stratigraphically distinct units.

1) The oldest has been designated the Lower Mafic Unit which consists of pillowed to massive flows of tholeiitic basalt.

2) Overlying the Lower Mafic Unit is a diverse predominantly volcanic succession designated the Upper Mixed Unit. It consists of tholeiitic basalt flows, calc-alkaline basaltic andesite to andesite flows, debris flows, felsic pyroclastics and minor intercalated clastic to chemical sediments.

3) Sediments of the White Partridge Bay group overlie the Upper Mixed Unit in the northeast. In the map area only the lower-most portion of the Group is present which consists of wackes, mudstones and siltstones with minor interbedded turbiditic conglomerates. This group is interpreted to be Timiskaming type sediments unconformably overlying the volcanics of the map area.

Synvolcanic ultramafic to mafic, differentiated to undifferentiated sills and intermediate to felsic porphyry dikes, sills and small stocks intrude the Lower

Mafic and Upper Mixed Units but not the White Partridge Bay Group.

A series of tight east to northeast trending folds and a broad anastomosing shear zone in the south (designated the Crowduck Lake - Witch Bay Shear Zone) are the dominant structural elements of the area.

Granitic gneisses of the Winnipeg River Subprovince occur in the north with abrupt, uncomformable or tectonic contacts in the east and intrusive contacts in the west.

Granitic intrusions consist of the pretectonic Winnetka Lake and Ridge Lake stocks, the syntectonic Granite Lake and Rush Bay stocks, and the late tectonic Canoe Lake stock.

Gold occurs in two distinct structural settings in the map area:

1) Quartz veins in narrow zones of brittle to ductile deformation with limited alteration.

2) Widely dispersed in broad zones of ductile deformation with widespread alteration.

Porphyry-type copper-molybdenum-zinc mineralization is associated with the Canoe Lake stock.

GEOLOGY OF THE CLEARWATER BAY AREA

DISTRICT OF KENORA

by

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INTRODUCTION:

Location and Access

The Clearwater Bay area lies in the northwestern portion of Lake of the Woods about 20 km southwest of Kenora in the District of Kenora. An area of about 220 km^2 was covered at 1 inch to 1/4 mile scale (1:15 840) approximately bounded by latitudes 49° 37'N to 49° 45'N and longitudes 94° 40'W and 94° 53'W (Figure 1).

Access to much of the area is by water from Lake of the Woods. The northern part can be accessed from Highway 17 and numerous secondary roads.

Present Geological Survey

Field mapping was conducted during the summer of 1986. The area is a westward extension of mapping of the northern part of Lake of the Woods begun to the east in the Bigstone Bay Area in 1984 (Ayer et al 1985), and continued in the northcentral portion in the Rat Portage Bay area in 1985 (Ayer and Gil, 1985). Mapping was at a scale of 1 inch to 1/4 mile (1:15,840). Outcrop data was recorded on aerial photographs and transferred to Ontario Base Map cronaflexes corrected to 1 inch to 1/4 mile scale. Mapping was concentrated on shoreline exposures with inland pace and compass traverse lines spaced at about 400 m intervals but also oriented to examine the maximum amount of outcrop perpendicular to the regional strike.

Previous Geological Work

The first complete geological map of the Lake of the Woods was by Lawson (1885). Lawson introduced the term Keewatin for the Archean supracrustal rocks in Lake of the Woods.

Coste (1895) and Coleman (1895, 1896) visited

various properties within the map area and reported on mining activities.

The western part of the map area was mapped at 1 inch to 1 mile scale (1:63 360) by Greer (1931).

The eastern part of the area was covered at 1 inch to 1 mile scale (1:63 360) by Thomson (1937). He proposed the Archean sedimentary rocks in northeastern Clearwater Bay were equivalent to Timiskaming strata i.e. unconformably overlying the Keewatin "greenstones".

Stratigraphic studies, with emphasis on lithogeochemistry of volcanic rock units were conducted in the eastern part of the map-area by Goodwin (1965, 1970) as part of large scale investigations of the Western Wabigoon Subprovince.

Recent 1 inch to 1/4 mile scale (1:15 840) geological mapping by Ontario Government geologists in the immediate vicinity of the map area is as follows: To the west by Davies (1965); to the south and southwest by Davies (1978, 1982); and to the east by the author (Ayer and Gil, 1986).

Mineral Exploration

The area has been intermittently explored for gold since the Lake of the Woods Gold Rush in the 1880's. During the "Rush" many small shafts, pits and trenches were excavated in the map area. It is probable that at least some of these produced small amounts of gold. However, there are no gold production figures on record for any of the properties in the map area.

Large scale airborne geophysical exploration for base metals covered much of the northern part of Lake of the Woods including the map area in the 1960's and 1970's. Some of the more significant geophysical anomalies were followed-up by diamond drilling with generally discouraging results.

The area underlain by the Canoe Lake Stock, including that portion within the southwestern part of the map area, has been explored for porphyry copper mineralization since the late 1960's.

In recent years (since the mid 1970's) the area has undergone a revitilization of interest in gold. Exploration work since this period has included airborne and ground geophysical surveys, geochemical surveys, detailed geological mapping, stripping, trenching and sampling. Much of the detailed work is in the vicinity of previously recognized gold properties.

Physiography

Lake of the Woods averages about 1060 feet (323 m) above sea level. Topography is moderately rugged with abundant outcrop exposed along a highly indented shoreline with variable amounts of outcrop in the interior. Outcrop is most abundant over the granitic bodies. Elevation achieves a maximum of about 1300 feet (396 m) in the north over orthogneisses of the English River Subprovince.

Areas of swamp are small, generally not exceeding a maximum of 2 km^2. Numerous small lakes occur on the land

surrounding and draining into Lake of the Woods. Lakes in the northcentral and northeast part of the map area drain northeast into the Winnipeg River.

Acknowledgements

The writer was assisted by J.M. Sweeny, M.J. Michaud, D. Rowe, C.W. McKeachie and H. Tumanowski. J.M. Sweeny, as senior assistant, was responsible for about one-half of the mapping and in particular for much of the mapping of the large granitoid bodies.

Thanks are extended to Michael Flanagan of Homestake Mineral Development Company for access to company airborne geophysical data and for helpful discussions on the geology of the map area.

GENERAL GEOLOGY:

A generalized distribution of lithological units and structures in the map area is presented in Figure 2. Supracrustal rocks belong to three stratigraphically distinct groups.

1) The oldest is designated the lower Mafic Unit and consists of pillowed to massive mafic flows.

2) A middle group designated the Upper Mixed Unit consists of mafic to intermediate pillowed to massive flows, heterolithic debris flows and felsic pyroclastics. The volcanics are locally intercalated with clastic and chemical sediments.

3) An uppermost group of Timiskaming type sedimentary rocks designated the White Partridge Bay Group

unconformably overlies the Upper Mixed Unit. In the map area it consists predominantely of fine-grained, turbiditic wackes, siltstones, and mudstones representing the basal portion of the group. East of the map area, a more complete stratigraphic section shows coarsening upwards into medium-grained, massive to cross-bedded sandstones and conglomerates with granitoid pebbles (Ayer 1985).

The Lower Mafic and Upper Mixed Units, but not the White Partridge Bay Group, are intruded by synvolcanic mafic to ultramafic differentiated sills, and felsic to intermediate porphyry dikes, sills, and small stocks.

Metamorphic grade ranges from greenschist facies throughout most of the map area to amphibolite facies in the north adjacent to the Winnipeg River Subprovince orthogneisses.

Several ages of granitic intrusion are apparent in the area. The oldest are pretectonic tonalitic to granodioritic gneisses of the Winnipeg River Subprovince in the northern part of the map area (Clark et al 1983). In the northcentral portion of the map area orthogneisses are in direct intrusive contact with mafic metavolcanics of the lower Mafic Unit. To the east, a marginal unit of alkali feldspar megacrystic grandiorite is in abrupt contact with the Lower Mafic Unit. It grades to the north into orthogneisses. In the west, pretectonic quartz monzodiorite to granodiorite and diorite of the Winnetka Lake Stock are in intrusive contact with the lower Mafic Unit, and grade into orthogneisses to the

north. The Ridge Lake stock is also pretectonic, it has a similar composition to, and may be an apophysis of the Winnekta Lake stock.

The Granite Lake stock is syntectonic. It consists of homogeneous alkali feldspar megacrystic granodiorite intruded into metavolcanics with a thin septum of amphibolitized mafic metavolcanics of the lower Mafic Unit separating it from the Winnetka Lake stock to the north.

The Rush Bay stock is also syntectonic. It consists of Rapakivi textured plagioclase and alkali feldspar porphyritic quartz monzodiorite intruded into metavolcanics in an extensive zone of high strain known as the Crowduck Lake - Witch Bay Shear Zone.

The Canoe Lake Stock is late tectonic. It consists of equigranular to porphyritic tonalite. The stock has hydrothermal alteration ranging from extensive propylitization to localized phyllitic and restricted potassic alteration.

Minor late Archean kersantite lampyrophyre dikes cut volcanics and granitoids in the southern part of the map area.

A large early proterozoic diabase dike trends northwesterly across the northeast part of the map area. It belongs to the Kenora-Kabetogoma Swarm dated at about 2.1 GA (Halls 1982, 1986).

Table 1 lists the lithological units present in the Clearwater Bay area and the detailed geology is presented on the Preliminary Geology Map (in back pocket).

Archean

Metavolcanics and Metasedimentary Rocks

Mafic Metavolcanics (Unit 1)

Lower Mafic Unit

Mafic volcanic rocks represent a relatively minor proportion of the volcanic rocks in the map area. They occur in two distinct stratigraphic positions within the map area. The oldest rocks occur within the western extension of Lower Mafic Unit identified in the Bigstone Bay and Rat Portage Bay areas to the east of the map area (Ayer et al. 1985, 1986). Lower Mafic Unit volcanics are most abundant in the north in a band up to 1 km wide trending northeast across the map area roughly parallel to Highway 17. A minor amount of Lower Mafic Unit volcanics also occur in various localities in the south. They are located in the south part of Ash Bay, on the northwest side of Ogema Bay and in the north part of Cul De Sac Lake. However, here they are extensively intruded by differentiated mafic sills.

Rocks of the Lower Mafic Unit are typically aphyric, pillowed to massive basaltic flows. Local horizons of porphyritic basalt with coarse-grained equant plagioclase phenocrysts up to 2 cm are restricted to the northern band near the stratigraphic top of the Lower Mafic Unit in the vicinity of Deception Bay. The porphyritic basalts occur as fine-grained pillowed to massive flows, and medium grained gabbroic textured sills or thick massive flows.

In the north part of the map area flows of the Lower

Mafic Unit are fine grained and dark brownish-green on weathered surfaces. Locally thin darker green pillow selvages are preserved. Pillows are generally highly flattened and are up to several metres long by up to 50 cm thick.

Extensive metamorphic recrystallization to lower amphibolite facies has obliterated much of the finer-scale primary texture in the groundmass of the flows.

In the south the mafic volcanics of the lower Mafic Unit are less recrystallized within the greenschist facies of regional metamorphism. They occur as fine-grained, dark green to buff weathering, pillowed to massive flows. Pillows are rounded and up to 1 m thick. Selvages are thin, dark coloured and locally have medium-grained varioles concentrated toward the pillow rims. South of Ash Bay a quench texture is preserved in massive and pillowed flows. It consists of coarse-grained branching and radiating mafic crystals (now altered to tremolite-actinolite) up to several cm long in a fine-grained groundmass of plumose radiating actinolite intergrown with elongate plagioclase crystals (Photo 1).

Breccias consisting of hyaloclastite, pillow, and flow breccia were observed in the Lower Mafic Unit in its northern and southern exposures.

Upper Mixed Unit

Mafic volcanics also occur within the Upper Mixed Unit intercalated with intermediate to felsic volcanics. The thickest concentration is in the east central part of

the map area and may extend (under water) to join with thinner mafic bands in Rush Bay in the west central part of the map area. They also occur in the eastern part of Ptarmigan Bay and in minor amounts in various other localities in the Upper Mixed Unit.

Mafic metavolcanic rocks within the Upper Mixed Unit occur as pillowed to massive flows. They are aphyric to plagioclase phyric, with fine-grained lath-shaped phenocrysts, and are commonly amygdaloidal with fine to medium-grained carbonate and/or quartz-filled vesicles. These volcanics are fine-grained and medium green to dark greenish-brown on weathered surfaces. Pillows are rounded and up to 1 m thick with thin dark green selvages. Locally the pillowed flows are variolitic with lighter green spheroids up to 5 mm which tend to coalesce in irregular patches up to 30 cm long in the pillow cores. Breccias consisting of interpillow hyaloclastite, pillow breccia and flow breccia are locally present.

Thus mafic flows of the Upper Mixed Unit contrast with the Lower Mafic Unit in that they are generally plagioclase phyric, amygduloidal, weather a different colour and are commonly variolitic.

Petrography

Lower Mafic Unit mafic metavolcanics are typically fine-grained and aphyric consisting of felted masses of subhedral to euhedral actinolite-temolite (up to 70%), subhedral plagioclase (up to 30%) (overgrown by very fine-grained epidote) with or without accessory or trace

amounts of carbonate, chlorite, epidote, titanite and opaque minerals.

South of Ash Bay some of the massive and pillowed flows contain up to 30% coarse-grained, branching and radiating euhedral mafic crystals interpreted to be primary quenched phenocrysts up to several cm long (Photo 1), replaced by fine-grained tremolite. These occur in a fine-grained groundmass of plumose felted intergrowths of subhedral actinolite or tremolite and plagioclase.

A thin section of massive medium-grained plagioclase porphyritic mafic sill or massive flow from Deception Bay (Figure 3) contains medium to coarse, equigranular, euhedral, primary plagioclase phenocrysts of labradorite composition (An70) in a subophitic groundmass of secondary, medium-grained poikiolitic amphibole (actinolite or tremolite after pyroxene) with inclusions of fine-grained groundmass plagioclase.

Mafic flows within the Upper Mixed Unit commonly contain up to several percent fine-grained euhedral lath-shaped plagioclase phenocrysts (up to 1 mm). These occur in a very fine-grained groundmass of trachytic to pilotaxitic, euhedral, altered plagioclase microlites intergrown with subhedral amphibole and/or chlorite with accessory to trace carbonate, quartz, epidote, titanite and opaque minerals. Plagioclase content ranges up to a maximum of about 50% and they are typically strongly altered to albite with overgroths of very fine-grained epidote.

Interpretation

The pillowed nature and general absence of vesicles in the flows of the Lower Mafic Unit suggest deposition in submarine conditions in relatively deep water, i.e. greater than 2000 m (Jones, 1969). The presence of amygdules in mafic flows from the Upper Mixed Unit indicates a relatively shallower depth of emplacement for the Upper Mixed Unit.

Intermediate Metavolcanic Rocks (Unit 2)

Rocks of this unit belong to the Upper Mixed Unit which consists of a diverse assemblage of mafic to felsic volcanics conformably or disconformably overlying the lower Mafic Unit. Two main varieties of intermediate volcanic rocks occur within the map area. They are: pillowed to massive plagioclase porphyritic flows; and heterolithic volcanic debris flows.

Flows

Flows are most abundant in a band up to 2 km wide trending east northeast across the central part of the map area from south of Woodchuck Bay to Corkscrew Island. In this band pillows can be very large. South of Woodchuck Bay pillows were observed up to 12 m long by 4 m thick.

The intermediate flows are fine-grained and green to buff grey coloured on weathered surfaces. Pillow selvages are thick (up to 1 cm) and lighter coloured than the pillow cores. Amygdules are common and range from

0.1 to 10 cm. They are typically filled with carbonate with or without quartz, chlorite, epidote, and opaque minerals. On the northwest side of Ash Bay radiating fractures were observed extending from pillow cores into spherical, medium-grained vesicles concentrated around the pillow rims.

Flows along the east shore of Ogema Bay are very fresh in appearance with many primary textures preserved. In this locality finely laminated banded flows (Photo 2) are intercalated with pillowed flows. Also highly irregular pillows(?) are intercalated with flows with abundant very large amygdules up to 10 cm aligned parallel to the flow direction (Photo 3).

Locally flows grade upwards and laterally into isolated pillows and brecciated pillows in hyaloclastite. Sea floor alteration appears to have affected some of these breccias. On the northeast side of Ash Bay, light grey (bleached?) hyaloclastite occurs (Photo 4). Observation of some of the fragments indicate alteration rinds discontinuous around fragments (Photo 5). This is an indication that the brecciation occurred after the alteration.

Debris Flows

Intermediate debris flows consist of heterolithic angular to subrounded fragments (Photo 6) in a fine-grained matrix with abandant crystals. Clasts range from mafic to felsic, but are of predominately intermediate composition. Clasts are: porphyritic to non-porphyritic,

amygdaloidal to non-amygdaloidal flow fragments; crystal-rich tuffaceous fragments; and fine-grained, equigranular fragments of synvolcanic intrusive and/or flow origin. The fragments range up to 1 metre but are mostly in the block to lapilli size range. Locally the coarser fragmentals are interbedded with fine-grained, crystal-rich or very fine-grained, thin, laminated bedded tuffs (Photo 7).

Certain characteristics of these fragmental deposits favour their interpretation as debris flows or volcaniclastic deposits rather than primary unreworked pyroclastics. These include the nature of the clasts (i.e. heteolithic and predominately of flow origin), the normal grading within depositional units, and the finely laminated to bedded tops of some of the depositional units. These criteria, documented in more detail in reports from the Bigstone Bay Area (Ayer et al, in press), suggest they were deposited as subaqueous debris flows after the criteria of Fisher (1982).

Petrography

Intermediate flows are commonly plagioclase porphyritic with up to 30% fine to coarse-grained, lath-shaped, euhedral phenocrysts up to 1 cm long. Plagioclase also occurs as very fine- to fine-grained euhedral to subhedral microlites in the groundmass with either a subparallel trachytic or random pilotaxitic texture. Plagioclase can comprise up to 80% of the rock and is commonly altered to very fine-grained epidote with

or without sericite, and carbonate. Unaltered plagioclase phenocrysts range in composition from oligoclase to andesine. The groundmass consists of very fine-grained to fine-grained subhedral amphibole with or without chlorite, quartz, and biotite and with accessory to trace carbonate, epidote, titanite and opaque minerals.

Amygdaloidal flows and associated debris flows exposed along the north shore of Clearwater Bay east of McCallum Point contain anomalous biotite (up to 25%). This and the presence of several mineral occurrences in this area (see Argyle Occurrence and Manitoba Consolidated Occurrence) suggests potassium metasomatism for this area.

Locally, along the north shore of Clearwater Bay the groundmass of intermediate flows, debris flows and volcanic intrusions are overgrown by fine-grained, euhedral actinolite porphyroblasts. This was only observed north of Clearwater Bay indicating increasing thermal metamorphic grade within the "greenstones" in the northern part of the map area.

Debris flows contain angular to subrounded lithic clasts consisting of porphyric and aphyric flows, crystal-bearing tuffaceous clasts, and a minor amount of fine-grained subhedral granular textured plagioclase-rich rocks which may be of either massive flow and/or synvolcanic intrusive origin. The fragments occur with angular broken crystal of plagioclase, minor mafic crystals (altered to amphibole or chlorite), and quartz.

The matrix consists of very fine-grained to fine-grained plagioclase, quartz and chlorite with or without amphibole, and biotite and with accessory to trace amounts of carbonate, epidote and opaques with or without sericite and titanite.

Interpretation

A subaqueous depositional environment is clearly indicated for the intermediate volcanics from the intercalation of pillowed flows, sediments and debris flows which show characteristics of subaqueous deposition such as normal grading, and bedded tops (Fisher, 1982).

The abundance and size of vesicles in the lava flows suggests a relatively shallow water environment particularly in comparison with the non-amygdaloidal flows in the underlying Lower Mafic Unit. (cf. Jones, 1969, McBirney & Williams 1979).

The intimate intermixture of lava flows and debris flows also suggests the two were deposited contemporaneously. It is likely that areas with abundant lava flows were proximal to eruptive centres and areas with abandant debris flows were situated in depressions off these flanks of the centres.

Felsic Metavolcanic Rocks (Unit 3)

Volcanic rocks of this composition (i.e. colour index less than 10) occur as bands and lenses intercalated with intermediate and mafic volcanics of the Upper Mixed Unit. A very distinctive horizon of these

rocks extends from Chebucto Lake in the west to the east side of Zig Zag Island and from there is folded back to the northeast side of Zig Zag Island (Map in back pocket). It is exposed over a strike length of at least 10 km and is up to 400 m thick. Other less extensive lenticular felsic volcanic horizons range from single outcrops to zones up to 500 m thick and several km long.

The felsic volcanics are predominately fragmental rocks. These consist mostly of crystal to aphyric tuffs with subordinate lapilli tuffs and tuff breccias. In some the fragments are angular and consist of tuffaceous to pumiceous clasts of a composition similar to the groundmass. Crystals consist of broken and angular quartz and feldspar (plagioclase with or without alkali feldspar). However, some of the felsic volcanics are felsic varieties of debris flows. The clasts are subangular to subrounded lithic fragments which are heterolithic in composition, and crystals of plagioclase are more abundant than quartz.

In two localities, one on the southwest side of Victoria Island and the other on the east side of Cul De Sac Lake massive fine-grained, plagioclase porphyritic, felsic bands contain well preserved columnar jointing (Photo 8). On Victoria Island the columnar jointed horizon is 12 m thick. It is not certain if these are flows, tuffs, or sills.

A distinctive felsic horizon extends from Chebucto Lake to Zig Zag Island (Map in back pocket). It can be distinguished from other felsic volcanics in the map area

in that quartz and alkali feldspar phenocrysts are abundant (in roughly subequal amounts up to a total of about 30%) and plagioclase phenocrysts are relatively minor (up to 5%). The southern portion of this horizon is predominantly massive crystal tuffs with some isolated localities where fine to medium-grained pumiceous fragments or subtle banding features can be distinguished. The northern portion of the unit is more distinctive containing abundant coarse fragments and locally thinly bedded crystal tuffs with very fine-grained black cherty beds.

This transition is well exposed along the shoreline of the east side of Zig Zag Island (Map in back pocket). Here, the southernmost 100 m of tne unit is massive quartz-feldspar crystal tuff with some subtle layering locally exposed. The northernmost 30 m of exposure consists of five texturally distinct layers from 2.3 m to 11.5 m thick (Figure 3). The layers range from tuff breccias to lapilli tuffs with one very distinctive layer 11.5 m thick consisting of alternations of normally graded crystal tuffs with thin beds (up to 10 cm thick) of very fine-grained black cherty tuff (Photo 9). Grading and soft sediment deformation consisting of flames and ball and pillow structures (Photo 9) at the base of sandy tuff beds indicate tops to the south.

Petrography

Fragments from the felsic ignimbrite horizon on Zig Zag Island consist predominately of aphyric to

porphyritic pumice. These are distinguished by highly irregular shapes and locally by flattening with fiame-like terminations suggesting incipient welding in some localities (Photo 10). Angular to subangular lithic or tuffaceous clasts are porphyritic to aphyric (Photo 10) and undeformed. Phenocrysts constitute up to about 30% of the rock. They consist of quartz (up to 15%), microcline (up to 15%) and plagioclase (up to 5%).

The matrix consists of very fine-grained anhedral granoblastic quartz and feldspar with subhedral lepidoblastic sericite with or without biotite, and accessory to trace amounts of carbonate and opaque minerals.

In the other felsic metavolcanic occurrences in the map area, (and the areas mapped to the east, Ayer et al, 1985, 1986) plagioclase crystals are more abundant (up to 50%). Quartz crystals may or may not be present in significant quantities, and microcline was not observed.

Interpretation

The main felsic horizon from Chebucto Lake to Zig Zag Island is interpreted to be pyroclastic in origin. The vertical succession of primary structures (i.e. tuffaceous base, an unbedded, ungraded mid portion and bedded tuffaceous tops), presence of pumice, monolithic composition, and development of stretching textures suggestive of welding, indicate the unit is a subaerially erupted ignimbrite comparable to other Archean occurrences (cf. Thurston, 1980).

A subordinate amount of the felsic fragmental volcanics may be felsic debris flows which are stratigraphically associated with the intermediate debris flows. These felsic debris flows tend to have less angular clasts and are heterolithic in composition. Phenocrysts of plagioclase predominate, with or without minor quartz, and alkali feldspar phenocrysts are absent.

A subaqueous environment is indicated for the felsic metavolcanics of both pyroclastic and debris flow origin. However, it is possible that the pyroclastic horizon was subaerially erupted and deposited in a subaqueous environment on the flanks of the eruptive centre. A relatively shallow water environment is implied by their intercalation with highly vesicular pillowed flows.

Metasedimentary Rocks (Unit 4)

Two stratigraphically distinct groups of sediments occur in the map area. The sedimentary rocks of this unit (Unit 4) are intercalated with volcanics of the Upper Mixed Unit. Another sedimentary unit designated the White Partridge Bay Group (Unit 8) overlies the Upper Mixed Unit and is described later.

The sediments within the Upper Mixed Unit occur as relatively small isolated lenticular horizons up to about 200 m wide and 2 km long. They are most abundant in the west central part of the map area but also occur scattered throughout the Upper Mixed Unit.

The metasediments predominantly consist of very thinly to thinly bedded (1 to 5 cm) siltstones and/or

argillitic mudstones, locally with thin to thick interbeds (3 to 30 cm) of fine-grained felspathic wacke. The siltstones are siliceous and light grey on weathered surfaces and are commonly normally graded. On a small island in eastern Ptarmigan Bay thin to thick bedded siltstones and wackes are cut by amygdaloidal mafic dikes and sills which are probably feeders to overlying mafic flows (Photo 11).

Minor exposures of ironstone occur in various locations within the Upper Mixed Unit. These consist of sulphide-chert ironstone and in one locality silicate-magnetite ironstone. The ironstones are very limited in vertical and lateral extent, typically restricted to single outcrops and are not traceable on the aeromagnetic map (1136G ODM-OGS 1962).

The best exposure of sulphide ironstone is on the east side of a small island about 1 km northeast of Victoria Island. The sulphide rich zone is about 10 m thick but is highly folded and could not be traced to the west side of the island. Alternating pyrite-rich and thinly laminated chert beds range from 5 to 20 cm thick. Pyritic beds consist of up to 30% very fine-grained pyrite concentrated as spherical "concretions" up to 1 cm in diameter in a very fine-grained siliceous matrix. In the northern part of the outcrop these change into interbedded chert and dark grey argillite locally with highly disrupted chert beds (Photo 12).

Silicate-magnetite ironstone occurs on the north side of a small island 1 km southeast of Mud Portage

Channel.

It occurs near the contact between a thick mafic sill to the south and interbedded siltstones and wackes to the north. It is about 5 m thick and is exposed over a strike length of about 10 m. The unit is fine-grained and dark green. It consists of 75% very fine-grained amphibole (grunerite or actinolite) with 20% very fine-grained disseminated magnetite (with minor concentration in thin laminations up to 1 mm thick), 5% carbonate and trace quartz.

Petrography

Wackes typically consist of up to 80% fine-grained angular grains, mostly of feldspar with minor quartz, in a very fine-grained matrix of feldspathic silt with lepidoblastic chlorite and accessory to trace epidote, carbonate, sericite, and opaque minerals. The siltstones consist of very fine-grained feldspathic silt with minor chlorite, sericite, epidote and opaque minerals.

Interpretation

The clastic sediments of this unit are interpreted as volcaniclastic interflow sediments which may be the distal turbiditic equivalent of debris flows. They probably occurred more or less simultaneous with volcanism and are thus intimately intercalated with the volcanics.

The chemical sediments are very restricted in lateral and vertical extent and are interpreted as very

localized (ponded) exhalative sediments resulting from seafloor fumerolic emanations.

Metamorphosed Ultramafic and Mafic Intrusive Rocks (Units 5 and 6):

These units are described together because they commonly occur together. Mafic intrusions, however, also occur in undifferentiated intrusions or in differentiated sills in which no ultramafic portions were observed.

The intrusions are typically lenticular ranging up to about 1 km thick and 10 km long parallel to the stratigraphy. They intrude both the Lower Mafic and Upper Mixed Units, but not the overlying White Partridge Bay group.

The ultramafic portions of the sills are relatively minor (less than 5%) ranging up to about 60 m thick and 1 km long. They have been observed locally at the base of differentiated sills, but also within interior portions of some of the sills, indicating the relatively complex composite nature of some of the differentiated sills. In a typical differentiation sequence the base of a sill may consist of up to 20 m of peridotite, overlain by a pyroxenitic unit up to 40 m thick, in turn overlain by a gabbroic upper portion up to several hundred metres thick. The gabbroic portion may grade from melanogabbro to leucogabbro or quartz diorite. Contacts between compositional variations are typically gradational over several metres.

Metaperidotite is fine to medium-grained and knobby textured. Colour ranges from grey to dark grey green on

fresh surfaces, with a characteristic orangy-brown weathered surface. They are typically talcose and magnetic. Metapyroxenites are fine to medium-grained, dark green on fresh surface, and dark green to brown on weathered surfaces. They differ from the metaperidotites in that they can contain up to 10% plagioclase and typically non-magnetic.

The classification of mafic intrusions is partially based on colour index: with melanogabbro from 90 to 60; gabbro from 60 to 30; and leucogabbro less than 30. Quartz gabbro and quartz diorite have a similar range of colour indicies to gabbros and leucogabbro respectively, but contain more than 5% quartz. Locally the mafic intrusives contain up to 10% magnetite and are highly magnetic. The mafic intrusions are fine to medium-grained, equigranular, and range from dark green to light grey green on fresh and weathered surfaces.

Petrography

A single specimen of knobby peridotite was examined in thin sections. It consists of fine to medium-grained cumulate anhedral serpentinized olivine (40%) and talcose pseudomorphs after pyroxene (orthopyroxene?) (20%), in an intergranular fine-grained groundmass of subhedral chloritized clinopyroxene (?) (20%) with minor amphibole (5%) and magnetite (5%).

The mafic intrusions contain subhedral-granular to subophitic intergrowths of pyroxene (altered to amphibole or chlorite) and plagioclase (altered to epidote +-

chlorite +- carbonate) with accessory to trace magnetite, with or without quartz and apatite.

A thin section from the upper portion of a differentiated sill on the northeast side of Ogema Bay is medium-grained, subhedral-granular quartz diorite. It is unusual in that it contains about 5% fine to medium-grained anhedral microline. It also contains unaltered subhedral plagioclase (60%) of oligoclase composition (An_{21}), chloritized and epidotized subhedral amphibole (20%), subhedral magnetite (10%), anhedral quartz (5%) and euhedral apatite (trace).

Another thin section from the leucocratic portion of a differentiated sill about 1 km southwest of Victoria Island is granophyric quartz diorite. It consists of fine-grained unaltered subhedral oligoclase (An_{20}) laths (60%) with fine to medium-grained intergranular granophyric intergrowths of quartz and feldspar (20%), anhedral quartz (10%), chloritized and epidotized subhedral amphibole (10%), and opaque minerals (trace).

Metamorphosed Felsic to Intermediate Intrusive Rocks (Unit 7):

Rocks of this unit occur in dikes, sills and small stocks interpreted to be of synvolcanic origin but which may also include intrusions related to later granitic intrusions (Units 9 and 10).

Two relatively large intrusions of this unit occur in the northeast part of the map area. One is an irregular stock about 1.5 km long intruded at the contact between the Lower Mafic and Upper Mixed Units at

Hinterland Lake. The other is a sill up to 300 m thick and 2.5 km long west of Inglis Lake.

Rocks of this unit are commonly porphyritic with plagioclase with or without quartz and amphibole phenocrysts in a fine- to very fine-grained groundmass. Locally the intrusions are fine-grained aphyric felsite. Compositions range from felsic to intermediate.

White Partridge Bay Group Metasedimentary Rocks (Unit 8):

This unit occurs in the eastern part of Clearwater Bay, mainly on the northern part of Corkscrew Island (Map in back pocket). Only the lowermost portion of the unit is exposed in the map area.

A thicker stratigraphic succession up to 1.5 km thick is preserved east of the map area, north of White Partridge Bay (Ayer and Gil, 1986). In the White Partridge Bay area the group consists of a coarsening upwards succession with mudstones and fine-grained distal submarine wackes at the base. These change to interbedded massive to crossbedded sandstones and congomerates of possible fluviatile origin in the upper part of the group (Ayer, in press).

Within the map area only the lower portion of the group is exposed. It consists predominately of mudstone, siltstone and fine-grained wackes. Bedding ranges from 1 to 30 cm in thickness. Normal grading and soft sediment structures, such as slump folding and flame structures are common.

The basal portions of the group in its southwestern

exposures is unusual for the White Partridge Bay group. It consists of fine-grained massive to thickly bedded quartz wackes or crystal tuffs with local interbeds of thinly bedded siltstone and/or mudstone.

Intercalated beds of normally graded turbidic conglomerate are up to 1 m thick. They are most abundant along the north shore of Corkscrew Island. They contain angular mudstone rip-ups with wacke and minor volcanic clasts (Photo 13) and are commonly normally graded. In some erosional bases are evident which trucate underlying beds at a low angle.

Interpretation:

The sedimentary rocks of the White Partridge Bay group were interpreted as a Temiskaming equivalent unit by Thomson (1937). Evidence bearing on this interpretation is summarized below. Most Temiskaming equivalent successions consist of calc alkaline to alkaline volcanics emanating from largely subaerial stratavolcanoes with laterally equivalent volcaniclastic debris flows and fluviatile sediments (Ayres and Thurston 1985). These sequences include extensive fluviatile sediments and in the late stages in the type area and elsewhere are seen to be deposited prior to the second deformation (Corfu and Stott 1986). The White Partridge Bay group fits this model in that:

1) heterolithic conglomerates with rounded syntectonic granitoid clasts occur intercolated with crossbedded fluviatile sandstones.

2) A lack of pretectonic mafic intrusions and synvolcanic porphyry sills cutting the group.

3) On the west side of Corkscrew Island an east-northeast trending mafic sill is truncated by White Partridge Bay groups sediments interpreted as an erosional unconformity.

4) The group may be correlative on lithological grounds with the Crowduck Lake group (Davies 1965) which has a well exposed unconformable relationship to underlying Keewatin strata.

These observations suggest the White Partridge Bay group unconformably overlies the Keewatin strata and that the Group postdates both synvolcanic intrusions of the Keewatin and early granitoid activity.

Pretectonic to Syntectonic Felsic to Intermediate Intrusions (Unit 9)

Intrusions included in this unit range from pre to syntectonic. Pretectonic intrusions include those of the Winnipeg River Subprovince in the north, and in the west the Winnetka Lake stock and the Ridge Lake Stock. The Granite Lake Stock is considered to be syntectonic.

Winnipeg River Subprovince

Rocks of the Winnipeg River Subprovince occur in a broad band across the northern portion of the map area. In the northeast they are in abrupt possibly unconformable (Clark et al 1981, Beakhouse 1985) or tectonic contact with Lower Mafic Unit volcanics of the Wabigoon Subprovince. On the southeast side of War Eagle

Lake (Map in back pocket) a marginal band of alkali feldspar megacrystic granodiorite is up to several hundred metres wide. The unit has an abrupt contact with volcanics to the south and grades into gneisses to the north. This unit is reportedly continuous for over 30 km to the northeast and has been tentatively dated at 2605 +- 9/7 Ma in the Keewatin area (Beakhouse 1985). It consists of subhedral to euhedral alkali feldspar phenocrysts up to 3 cm in a medium-grained, strongly foliated groundmass (Table 2, sample 112). West of War Eagle Lake the megacrystic granodiorite is not found and the contact between the Winnipeg River and Wabigoon Subprovinces is a zone of hybridization and brecciation. The metavolcanics are diked by granitic phases and some assimilation has occurred. This suggests an intrusive contact at this locality. Amphibolite inclusions up to 5 m wide occur throughout the gneisses. They are most probably inclusions of unassimilated mafic metavolcanics.

The gneisses range from biotite tonalite to biotite granodiorite (Table 2, sample 103). Gneissosity is defined by alternating plagioclase-rich and amphibole-rich bands 1 cm to 10 cm wide.

Winnetka Lake Stock

This stock has been intruded into the Wabigoon Subprovince volcanics in the northwestern part of the map area. It grades into orthogneisses of the Winnipeg River Subprovince north of the south side of Deception Lake and east of Rice Lake (Map in back pocket). To the south it

displays intrusive contacts with dikes of granodiorite into mafic metavolcanics of the Lower Mafic Unit.

Composition ranges from quartz monzodiorite to granodiorite with hornblende greater than biotite (Table 2, samples 438 and 468). Typically it is medium- to coarse-grained and equigranular. A well developed penetrative foliation is steeply dipping and parallel to the regional foliation. The foliation passes from the volcanics into the stock and inclusions without deviation. This supports the conclusion of Vagt (1968) that the foliation is of tectonic origin and that the intrusion was emplaced prior to tectonism.

An unusual phase of the stock occurs north of Rice Lake (Map in back pocket). It is lenticular in shape about 1 km wide and 2 km long parallel to regional foliation. It consists of coarse-grained hornblende diorite. The diorite contains coarse-grained, euhedral plagioclase laths (up to 2 cm) with subhedral intergranular hornblende (up to 1 cm) and minor fine-grained biotite, quartz, and microcline (Table 2, samples 414a and 415). Also present within the diorite body are inclusions of hornblendite up to 10 m wide consisting of up to 95% hornblende with minor plagioclase.

Ridge Lake Stock

A small stock extends from the west side of Granite Lake to Ridge Lake on the western margin of the map area (Map in back pocket). It is exposed over a length of about 1 km and is up to 1.5 km wide along the west side

of Granite Lake. The contact between this stock and the Granite Lake Stock lies under Granite Lake.

The Ridge Lake Stock ranges in composition from biotite granodiorite to hornblende diorite to plagioclase porphyritic biotite-quartz monzodiorite (Table 2, sample 462). Strongly hybridized zones of partial melting and intrusive breccias are common. Inclusions and associated intrusive phases have well developed penetrative foliations and locally granitic dikes are tightly folded. These features indicate the stock is of pretectonic origin.

Compositionally the Ridge Lake Stock is very similar to the Winnetka Lake Stock. Both stocks are pretectonic and occur in close proximity. It is therefore possible that the Ridge Lake Stock may be an apophysis of the Winnetka Lake Stock.

Granite Lake Stock

This oval stock occurs totally within the Wabigoon metavolcanics separated by a thin septum of mafic metavolcanics from the Winnetka Lake Stock north and west of Rice Lake (Map in back pocket). It is about 5 km long and 3 km wide with its long axis oriented east northeast.

It consists of homogeneous alkali feldspar megacrystic granodiorite. Subhedral to euhedral microcline phenocrysts are up to 3 cm and occur within a medium-grained, equigranular subhedral-granular groundmass of plagioclase, quartz, microcline, and biotite (Table 2, samples 163 and 405). A weakly

developed penetrative foliation follows the contacts of the intrusion and is not well developed in the interior.

In the south the intrusion is equigranular from the contact to about 500 m from the contact before the alkali feldspar megacrysts are well developed. A thin septum of amphibolitized mafic volcanics wrap around the north part of the intrusion. Foliations in the volcanics north and south of the intrusion parallel the contacts and rare inclusions within the intrusion are oriented east-west. These features would suggest the intrusion was emplaced syntectonically rather than pretectonically as was suggested by Vagt (1968). It also appears, in overall map pattern to have intruded and truncated the Ridge Lake Stock which is a pretectonic intrusion exposed on the west side of Granite Lake.

Syntectonic to Late Tectonic Felsic Intrusive Rocks (Unit 10)

Intrusions of this unit include the syntectonic Rush Bay Stock and late tectonic Canoe Lake Stock.

Rush Bay Stock

This lensoidal intrusion is oriented east northeast. It is 3 km long (to the western margin of the map area) and up to 1 km wide. It occurs within the Crowduck Lake - Witch Bay Shear Zone.

It consists predominantly of quartz monzodiorite with medium- to coarse-grained euhedral plagioclase and minor microcline phenocrysts (up to 1 cm) in a fine-grained groundmass (Table 3, sample 748). Locally a

Rapakivi texture is developed with microline phenocrysts mantled by plagioclase (Photo 14). This texture is preserved in the core of the intrusion but is obliterated towards the margins by a strong mylonitization which has resulted in augen shaped phenocrysts in a highly schistose and carbonatized groundmass.

Fine-grained aphyric felsite is gradational into the porphyritic phase at the southern and western margins of the stock.

Plagioclase - alkali feldspar porphyry dikes and felsite dikes related to the intrusion cut the volcanics southwest of the stock.

Canoe Lake Stock

This oval intrusion is about 11 km long and 6 km wide and oriented with its long axis towards the northeast. Only the northeastern portion (about 1/4 of the intrusion) occurs in the southwestern part of the map area. The intrusion was comprehensively studied by Campbell (1973). She has characterized the stock as follows:

"The Canoe Lake Stock is a massive, homogeneous, single phase quartz diorite intrusion". (Note - according to Streckeisen's (1975) classification it is a tonalite; Campbell used a classification scheme by Bateman (1961) which does not discriminate the quartz diorite field from those of tonalites and trondhjemites). "Its texture is medium-grained, hypidiomorphic-granular, and ranges from equigranular to seriate porphyritic with

large quartz eyes scattered through the rock. The quartz diorite ranges from light red and grey-red to grey and grey-green. Concentrations of quartz eyes and colour differences are irregular across the intrusive body. The pre-alteration mineral composition was 45 to 70% plagioclase (andesine), 15 to 50% quartz, as much as 15% hornblende, and a maximum of 15% biotite. Minor accessory minerals include ratile, sphene, apatite, and traces of magnetite and ilmenite. Minor hematite is commonly present as stringers crosscutting grains or surrounding grain boundaries."

Samples of equigranular and porphyritic tonalite were studied in thin section (Table 3, samples 700 and 483 respectively). The intrusion is transected by late dikes of quartz-feldspar porphyry, feldspar porphyry, fine-grained equigranular tonalite and felsite which also occur in the surrounding country rock.

Contacts with the surrounding rocks where visible are intrusive and show brecciation, diking and hybridization of the country rock. The centre of the intrusion is relatively unstrained with the effects of cataclastic strain increasing towards the margins of the stock. The surrounding rocks are foliated roughly parallel to the contacts and dip steeply away from the stock.

Hydrothermal alteration is pervasive with varying degrees of chloritization, carbonatization, epidotization and silification visible on a macroscopic scale.

The Canoe Lake Stock is interpreted as a shallow,

late tectonic pluton. The high degree of fracturing and copper-molybdenum-zinc mineralization indicate the body is an epizonal intrusion. The marginal cataclastic foliations and absence of a penetrative regional foliation in the stock suggest late tectonic emplacement with the central portion of the body remaining mobile during emplacement (Campbell 1973).

Mafic Intrusions (Unit 11)

Small lampyrophyre dikes were observed in several locations in the southern half of the map area. An unusual easterly trending lampyrophyre dike about 2 m wide contains rounded granitic to mafic inclusions in its central portion (Photo 15). The dike cuts pillowed mafic volcanics on a small island about 1 km east of Victoria Island. A northwest trending dike in the south central portion of Ogema Bay was examined in thin section. It is a medium-grained, subhedral-granular kersantite lampyrophyre with 50% subhedral plagioclase (unaltered andesine-An_{30}), 30% subhedral biotite, 18% euhedral to subhedral carbonate (which appears to be a primary magmatic component), 2% euhedral magnetite, trace pyrite and trace apatite.

Proterozoic

Mafic Intrusions (Unit 12):

A single large diabase dike trends northwest across the northeastern part of the map area. The diabase belongs to a group of dikes referred to as the Kenora-

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Kebetogama diabase swarm dated at about 2.1 GA (Halls 1982, 1986).

The dike is locally discontinuous and displaced in numerous small sinistral offsets. A major gap of 3 km occurs between Highway 17 (where the dike has been reduced to several small parallel dikes up to 1 m thick) and the northwest side of Boyne Lake where the dike reappears, up to about 100 m thick.

The dike and surrounding country rock are commonly epidotized for up to 10 m from the contact.

Phanerozoic

Cenozoic

Quaternary

Pleistocene

Unconsolidated sediments were deposited during various glacial stages in the Pleistocene. The last being the Wisconsinan stage (about 12,000 years B.P.). The deposits consist predominantly of unsorted till deposited in depressions between outcrop ridges. Subordinate stratified outwash deposits were observed in a few gravel pits in the north. These consist of thin to thickly bedded sand and gravel beds with locally developed crossbedding.

Abundant glacial striae were observed on shoreline outcrops and are consistently oriented towards the southwest.

During the retreat of the Wisconsinan sheet, glacial Lake Agassiz formed and fine material was washed from

topographic highs, leaving bare outcrops and localized clay deposits in the depressions. Clay derived from Lake Agassiz is found along mud of the shoreline of Lake of the Woods.

Recent

Stream and lake deposits of sand, silt, clay and organic material are presently being formed and concentrated on lake bottoms. Swamps and muskegs with organic deposits are scattered throughout the map area.

AEROMAGNETIC DATA:

Comparison of the geology of the Clearwater Bay Area (Map in back pocket) with the 1 inch to 1 mile (1:63,360) Aeromagnetic Map for the area (1186G ODM-OGS 1962) shows a relatively good large scale correlation between major units and aeromagnetic data.

Magnetic highs of up to about 61,000 gammas are associated with the large, differentiated mafic to ultramafic sills in the south.

Moderate highs of up to 60,700 gammas are associated with the Lower Mafic Unit in the north.

Rocks of the Upper Mixed Unit have moderate values from about 60,400 to 60,600 gammas. Localized highs can be correlated with mafic to ultramafic intrusions.

The sedimentary rocks of the White Partridge Bay Group are magnetically low with values less than 60,500 gammas and have very flat contour patterns.

The large granitic bodies have low to moderate

magnetic values from 60,300 to 60,600 with relative flat contour patterns.

PETROCHEMISTRY:

Introduction

Thirty-four samples were chemically analyzed for major oxides and selected trace and rare earth elements (REE) by the Geoscience Laboratory of the Ontario Geological Survey. Results are presented in Table 4 with corresponding sample descriptions in Table 5 and the sample locations on Figure 4.

Five of the analyses are of Lower Mafic Unit metabasalt (sample nos. 168, 358, 359, 600 and 756). Eighteen samples are of metavolcanics of the Upper Mixed Unit: They include five basalts (sample nos. 37, 38, 75, 172, 331 and 335); eight intermediate metavolcanics, which range from basaltic-andesite to andesite (sample nos. 20, 142, 371, 377, 629, 630, 753 and 755); and four ryholites (sample nos. 380, 631, 632 and 634).

Four of the analyses are from synvolcanic intrusions. They include peridotite from a differentiated sill (sample no. 349), a gabbro (sample no. 310), a leucogabbro (sample no. 309), and plagioclase porphyry (sample no. 27).

Seven analyses are of various granitic intrusions from the map area. Three are from the Winnecka Lake Stock (sample no. 468 is a composite of the samples collected along highway 17 south of Caribou Lake, and sample nos. 414 and 415 are from a dioritic phase of the

stock north of Rice Lake). One analysis is from the Ridge Lake Stock (sample no. 462). Another analysis is from the Granite Lake Stock (sample no. 405) and two are from the Rush Bay Stock (sample no. 748 is of porphyry from the central portion, and sample no. 627 is of felsite from the south margin of the stock).

Volcanic Geochemistry

A plot of SiO_2 (versus) $Na_2O + K_2O$ for volcanic rocks and synvolcanic intrusions are shown on Figure 5. It demonstrates the subalkalic nature of these rocks and the variation in SiO_2 values indicating a range of compositions from basalt to rhyolite for the volcanics. A substantial gap in SiO_2 values occurs from about 61% to 75% SiO_2. A similar feature was also observed in the volcanics from the Rat Portage Bay Area, although there the SiO_2 gap is smaller, from about 67% to 72% SiO_2 (Ayer, in press.)

Lower Mafic Unit

Analyses of Lower Mafic Unit volcanics are all of basaltic composition (anhydrous SiO_2 < 55%). They all plot within the tholeiitic fields on AFM and Cation diagrams (Figures 6 and 7). They are predominantly magnesian tholeiites as indicated on Figure 7.

Chondrite normalized plots of rare earth elements (REE) for the Lower Mafic Unit basalts (Figure 8) show relatively flat patterns with some depletion of light rare earth elements (LREE).

This feature has also been documented from the Lower Mafic Unit basalts in the Bigstone Bay area (Stix 1985). In addition, REE from basalts of this unit in the Rat Portage Bay Area also show the same pattern of depletion of LREE (Ayer, in press).

Upper Mixed Unit:

Basalts of the Upper Mixed Unit are also of tholeiitic composition as indicated by the AFM and Cation diagrams (Figures 6 and 8). Unlike the magnesian tholeiites of the Lower Mafic Unit within the map area, basalts of the Upper Mixed Unit are predominantly iron tholeiites (Figure 7). However, iron-rich tholeiites have been observed as relatively extensive within the Lower Mafic Unit to the east in the Bigstone Bay Area (Ayer et al, in press, Stix 1985) and the Rat Portage Bay Area (Ayer, in press). Basalts of these two units can be distinguished geochemically on the basis of REE patterns. Figure 9 shows the chondrite normalized values of REE for the basalts of the Upper Mixed Unit. When compared with those of the Lower Mafic Unit (Figure 8), they are distinctly enriched in LREE showing ratios of La:Lu generally greater than 1 (see Figure 9).

Intermediate flows of the Upper Mixed Unit range from basaltic-andesite to andesite in composition. They are distinctly calc alkaline in chemical affinity as indicated on the AFM and Cation diagrams (Figures 6 and 7). Chondrite normalized plots of these rocks (Figure 10) indicate moderate to strong enrichment in LREE,

similar but with generally steeper slopes than the basalts of the Upper Mixed Unit (see Figure 9).

Analyses of felsic volcanics of the Upper Mixed Unit all come from one ignimbrite horizon on Zig Zag Island. They are high silica rhyolites (SiO_2 > 75%) with a calc-alkaline chemical affinity as indicated on the AFM and Cation diagrams (Figures 6 and 7). Petrographically these rhyolitic ignimbrites are dissimilar from other felsic volcanics in the map area and areas to the east (Ayer et al, in press; Ayer, in press), in that they contain abundant alkali feldspar phenocrysts. In addition, this ignimbrite horizon is petrochemically dissimilar in the REE patterns. They show a distinct enrichment in heavy rare earth elements (HREE) and europium (Eu) depletion anomalies (Figure 11). For comparative purposes REE patterns of rhyolites from the Rat Portage Bay area are also shown (Figure 12).

This feature of relative enrichment of HREE and Eu depletion is very similar to that observed from some of the Cenozoic ash flow sheets in the southwestern USA such as the Bishop Tuff (Hildreth 1979). The most plausible explanation for such a feature is eruption from a high level, compositionally zoned magma chambre as the source of the ignimbrites (Hildreth 1979, 1981).

In the Cenozoic felsic volcanics with these patterns of enriched HREE and europium depletion patterns are commonly associated with mineralization such as rare metals, precious and base metal vein deposits the southwestern USA (Burt et al 1982). In the Archean they

are in many places associated with Cu-Zn massive sulphide mineralization and are considered to be "prime exploration targets" (Campbell et al 1982).

Synvolcanic Intrusions

A sample of peidotite from a differentiated sill south of Ash Bay falls within the komatitic ultramafic field on the cation diagram (Figure 7). This intrusion occurs in basalts of the Lower Mafic Unit and displays a low and flat trend of REE similar to that of the basalts (Figure 13, sample no. 349). The other analysed synvolcanic intrusions occur within the Upper Mixed Unit: They are of gabbro (sample no. 310), which falls in the high iron tholeiite field on Figure 7; leucogabbro (sample no. 309), occurring in the calc-alkaline basalt field of Figure 7; and plagioclase porphyry, occurring in the calc-alkaline andesite field on Figure 7. Their REE patterns (Figure 13) are similar to the volcanics of the Upper Mixed Unit (i.e. enriched in LREE - compare with Figures 8, 9, and 10). The similarity of REE patterns for the intrusions and volcanics in the Lower Mafic and Upper Mixed Units respectively implies the intrusions were derived from the same magma sources for each of these units respectively and that the volcanism and intrusions probably occurred more or less simultaneously.

METAMORPHISM:

Metamorphism to green schist facies occurs in the supracrustal rocks throughout most of the map area. The

lack of rocks of suitable composition (i.e. pelitic sediments) precludes further subdivision of the greenschist facies. Generally within 1 km of the large intrusive masses in the north supracrustal rocks have been metamorphosed to the amphibolite facies (based on the presence of hornblende and plagioclase).

Mafic and intermediate metavolcanics of the greenschist facies contain assemblages of albite, epidote and actinolite or tremolite, with or without chlorite, biotite, quartz, and carbonate. Those of the amphibolite facies contain plagioclase (oligoclase to andesine) and hornblende,with or without epidote, chlorite, garnet, quartz, and carbonate.

All felsic metavolcanics observed occur within the greenschist facies and contain assemblages of albite, quartz, epidote and sericite, with or withou microcline, biotite, chlorite, and carbonate.

Effects of localized high strain are evident throughout the map area. Strained zones are generally highly schistose with a phyllonitic texture indicative of mylonitization accompanied, or postdated by metamorphic growth of lepidoblastic micas. High strain zones are also commonly enriched in carbonate, typically a brown-weathering, iron-rich variety. Where mafic rocks are transected by high strain zones a chlorite-carbonate schist is developed and a sericite-carbonate schist in the felsic rocks.

STRUCTURAL GEOLOGY:

Introduction

A series of east to northeast trending tight folds and a broad easterly trending shear zone are the dominant structural elements within the map area (Figure 2).

East of the map area two separate phases of folding have been recognized by refolding of D1 folds by a later D2 event (Ayer and Gil 1986, Sanborn 1986). Two phases of folding have also been suggested to the west of the map area (Davies 1965). Within the map area no refolding of earlier folds was recognized. This suggests that the map area is a domain where only one phase was operative, or where a similar attitude of the two phases did not result in well developed refolding of earlier structures.

A broad shear zone in the south is referred to as the Crowduck Lake - Witch Bay Shear Zone (Figure 2). In the Rat Portage Bay area, east of the map area, Sanborn (1986) has stated "The shear zone is characterized by steep easterly plunging mineral lineations and shows evidence of major reverse, north-side-up displacement. Locally, horizontal surfaces display S fabric (schistosity) rotated into east-trending C fabric (shear planes) consistent with transcurrent dextral displacement. These fabrics may reflect reactivation of the shear zone."

Study of the shear zone west of the map area has also revealed fabric evidence to suggest subhorizontal and subvertical displacement. In this area subhorizontal movement was also dextral, but preliminary results suggest subvertical displacement resulted in the south

side moving up (Smith and Thomas 1986).

These studies indicate the kinematics of the Crowduck Lake - Witch Bay Shear Zone are complicated with two or more directions of displacement and a relatively long and complex structural history.

Folding

Fold axes have been located to a large extent on the basis of reversals in facing directions. A major syncline trends east across the map area from south of Woodchuck Bay across the northern part of Corkscrew Island (Map in back pocket). Parallel anticline and syncline just north of this major syncline are well defined in the White Partridge Bay Group and can be extended (on a more conjectural basis) to about half-way across the map area. They may extend further west but no reversals in facing directions were observed to support this. These three fold axes can be traced eastward into White Partridge Bay (Ayer and Gil, 1986). The major syncline appears to be continuous to the west of the map area with a syncline indicated by Davies (1965) northwest of Chebucto Lake.

A minor anticline and a syncline are indicated on the map (back pocket) west of the central part of Corkscrew Island. The anticline may extend easterly across Corkscrew Island to join with an anticline identified on the east side of the island (Ayer and Gil 1986).

Another minor anticline has been identified trending

northeast across Copper Island. A possible alternative would be to join the anticline observed on the east side of Corkscrew Island mentioned above with the Copper Island anticline. Unfortunately poor exposure in the central part of Corkscrew Island prohibits resolution of this problem.

A major syncline has been traced in the south from Ogema Bay northeast through the eastern part of Ptarmigan Bay (Map in back pocket). An anticline and a syncline parallel to each other occur in the southeast corner of the map area. This southernmost syncline is continuous with the Labyrinth Bay - Fox Lake syncline identified by Davies (1978) to the south. It can also be traced eastward across the northeastern part of the Western Peninsula (Ayer and Gil 1986). Relatively sparce evidence of top reversals indicate the anticline and syncline north of the Labyrinth Bay - Fox Lake syncline can be traced at least a short distance east of the map area, although no fold traces were indicated on the map face of the Rat Portage Bay Sheet for this area (Ayer and Gil 1986).

Minor folds on an outcrop-scale are rare in the map area and where observed are typically in thinly laminated sedimentary rocks. Fold styles are tight to isoclinal with steeply plunging hinges and weak to non-existent axial planar cleavages.

A steeply dipping flattening fabric related to the folding and/or shearing is developed across the area. It is defined by flattening of originally equidimensional

objects such as amygdules, pillows, etc. and a schistosity defined by the preferred orientation of micaeous minerals. Flattening planes generally strike within 15° of east-west.

Lineations are also widespread but less abundant. They are defined by elongation of originally equidimensional objects and/or a preferred orientation of elongate minerals. They have steep plunges and are generally close to parallel with the flattening plane. Orientations are most commonly east to northeast.

Ductile Deformation

Zones of high strain interpreted as shear zones occur throughout the map area. They range from a few centimetres to several kilometres in width. They consist of highly schistose rock with varying degrees of mylonitization accompanied or postdated by secondary mica growth resulting in a phyllonitic texture. In mafic protoliths the dominant lepidoblastic mineral is chlorite and in felsic protoliths it is sericite. These rocks are typically pervasively carbonatized, commonly with a brown weathering iron carbonate. More localized alteration consists of silicification (both pervasive and quartz-carbonate veining), iron sulphide enrichment, epidoxization, and chromium-enrichment (i.e. green mica schists).

The largest of the shear zones is the Crowduck Lake - Witch Bay Shear Zone. It has been traced for at least 80 km from the Manitoba border (Blackburn 1981) to Gibi

Lake (Trowell, 1986). It cuts across the map area from Rush Bay in the west to Ptarmigan Bay on the east. In the map area the structure consists of alternating zones of highly to moderately strained rock, which can collectively attain widths up to 2 km. The amount of deformation is in proportion to the competency of the original lithologies. Typically fine-grained rocks have strongly developed schistosities and alteration while the cores of medium-grained intrusions are relatively undeformed and unaltered.

Numerous splays project off the main shear zone. One major splay is deflected around the northern margin of the Canoe Lake Stock and then to the southwest into Shoal Lake. It has been identified as the Shoal Lake Deformation Zone and can be traced over a length of at least 30 km to Gull Bay on the southwestern shore of Shoal Lake (Smith and Thomas 1986).

Faulting

Numerous lineaments identified on the air photographs have been transferred onto the map face (Map in back pocket). Some of these are attributable to faults or shear zones, others are of uncertain origin. The most prominent trend of lineaments is easterly, parallel to the regional foliation. Northeasterly trending lineaments are also locally present.

Northwest trending faults with predominantly dextral displacement are indicated on Victoria Island and the Inglis Lake Occurrence (Figure 16).

It is likely that the diabase dikes were intruded into northwest-trending faults of a similar age. The sinistral east-west offset of diabase segments (Map in back pocket) might normally suggest east-trending fault or shear zone displacement. A possible alternative explanation is suggested from observations in the Rat Portage Bay area to the east (Ayer and Gil 1986). Here it was observed that the diabase dike was offset by about 1 km across the Crowduck Lake - Witch Bay Shear Zone. However, within the shear zone east-trending undeformed diabase with chilled margins was observed between the offset portions. This indicates that the dike post dates the faulting. It follows the deformation zone in a sinistral, step-like pattern.

Economic Geology

Introduction

The map area has a long history of mineral exploration dating back to about 1880. Gold was the focus for the early exploration work and it continues to be the most sought-after mineral commodity to the present time.

Exploration for volcanogenic base metal deposits was the main emphasis in the 1960's and 1970's without any encouraging results. Base metal deposits were sought by large scale airborne and geophysical surveys followed up by diamond drilling of the more significant anomalies.

From the late 1960's to present, the southwestern part of the map area, underlain by the Canoe Lake Stock has been intermittently explored for porphyry-copper style mineralization.

There are no producers on record for the map area. However, it is certain that many of the early workings produced relatively minor amounts of gold which were not recorded.

Gold

Gold mineralization is widespread throughout the map area with the exception of the large intrusions and the English River Gneisses in the north. Two distinct styles of mineralization are recognized. In one environment, gold is restricted to distinct quartz veins or the

immediately adjacent wallrock. In the other environment gold is more broadly dispersed in zones within major ductile shear zones.

Examples of the quartz vein type of mineralization are the Amygle Occurrence (No. 1), the Ash Bay Occurrence (Falconbridge Limited Property - No. 4), the Inglis Lake Occurrence (No. 8), the Three Friends Occurrence (G. Pogson Property No. 12), and the Unicorn Occurrence (Whiting Property - No. 16). In this type the gold is restricted to quartz veins up to 2 m wide. The veins typically occur in moderately to highly schistose wallrock which can be the locus of relative narrow zones of ductile deformation and alteration up to several metres in width on either or both sides of the vein. Locally the veins are deformed with pinch and swell structures or minor drag folds. The veins locally contain carbonate, tourmaline, muscovite, and minor sulphides. Varieties of sulphides can include pyrite, arsenopyrite, chalcopyrite, galena and sphalerite. Visible gold has been reported in some of the veins. The wallrock is typically carbonatized, and may be sericitized or chloritized depending on the composition of the host rock. Up to several percent finely disseminated pyrite is common in the wallrock and it can also contain anomalous gold values.

Examples of shear zone style gold mineralizations are the Echo Bay Occurrence (No. 2), the Echola Occurrence (No. 3), the Rush Bay and Homestead Occurrences (Homestake Mineral Development Company

Property - No. 6), and the Gauthier and Nonesuch Occurrences (Noranda Exploration Company Limited - No. 11). In this type of mineralization gold occurs in highly schistose and altered rocks within broad zones of ductile deformation such as the Cromduck Lake - Witch Bay Shear Zone or its associated splays. Alteration consists of widespread carbonatization and more localized sericitization and silicification. Gold is most closely associated with quartz flooding (both pervasive and in quartz - carbonate veins) and enrichments of disseminated pyrite up a maximum of about 10%. Locally gold is also associated with brecciation where relatively undeformed and highly altered angular fragments occur in a stockwork matrix of quartz and carbonate with disseminated pyrite in the fragments and the matrix. Such an area occurs at the southwestern tip of Corkscrew Island.

Copper - Molybdenum - Zinc

The area around Squaw Lake underlain by the Canoe Lake Stock has been explored for porphyry copper mineralization since the late 1960's (see Falconbridge Limited Property - No. 4, and Squaw Lake Occurrence - No. 15).

Campbell (1973) has described the area as follows: "Porphyry type copper mineralization pervades the Canoe Lake Stock. A complex zonal alteration pattern is centred near Squaw Lake and includes potassic, phyllic and propylitic halos. The sulphides are also zoned outwards from an inner area of chalcopyrite and

molybdenite outward to pyrite and chalcopyrite, and finally to pyrite and sphalerite".

Mineralization occurs as chalcopyrite (commonly altered to malachite), pyrite, pyrrhotite and locally sphalerite concentrated along widely spaced fractures and within thin shear zones. Pyrite and chalcopyrite also occur as minor disseminations within massive phases of the Canoe Lake Stock.

Description of Properties

Information on recent work in the area has been largely derived from the Resident Geologist's Files, Ministry of Northern Development and Mining, Kenora (RGFK), augmented by information from the Assessment Files Research Office, Ontario Geological Survey, Toronto (AFRO). These files contain only sparse records prior to 1950. Thus early work on the properties listed below is often based on reports of the Ontario Bureau of Mines and the Ontario Department of Mines as well as early reports by the Geological Survey of Canada. Ownership of mining rights is sometimes difficult to determine, especially where there are numerous cottage lots and therefore the Property List should be considered as only a guide, particularly for Patented Land.

Sampling by the Field Party

During the field mapping about 200 grab samples were collected by members of the field party from zones of recognized or potential mineralization throughout the map

area. The samples were analysed by the Geoscience Laboratories, Ontario Geological Survey, Toronto and the results with codes indicating the nature of the mineralization, the width of the zone from which the grab sample was selected, and the strike of the zones are tabulated in Table 6. The corresponding sample locations are shown on the Geology Map (back pocket).

Argyle Occurrence (No 1)

Several pits, trenches and a shaft are located at this location on Clearwater Bay. The work on this occurrence was done prior to 1885 and is described by Coste (1885).

The area is underlain by intermediate tuff breccias and lapilli tuffs, moderately to strongly foliated with an east northeast strike the rocks dip steep to the north. Locally adjacent to the old workings the metavolcanics are brownish weathering. In thin section the brown weathering is seen to be the result of abundant, very fine-grained biotite which appears to be an alteration after amphiboles.

The mineralization near the shaft has been described by Coste (1885) as follows:

> " Over a quarter of a mile further south is the second vein, with a strike of 100°; it dips south the same as the last mentioned vein, is wider (four to seven feet), and seems better defined. Two large pits, one on the shore of the lake, and a second, dignified with the name

of shaft, a little further back on the hill, have been made in this vein, the quartz of which is very white and hard and contains a little iron pyrite (pyrite), mispickel (arsenopyrite) and calcite;"

A grab sample of the quartz vein with a trace of pyrite collected from the shaft location by members of the 1986 field party yielded 365 ppb gold and 4 ppm silver (Table No 6, sample 22).

In addition Coste (1885) described a vein about 1/4 mile.PA (400 m) north of the above vein. He described it as follows:

" The more northward of the two varies from one to two feet in thickness only; it is very badly defined. It is not a quartz vein sharply cutting the surrounding schist. It has been exposed for about a quarter of a mile, and within that distance four or five large pits have been made in the vein. At one of these pits the vein divides into two small branches which reunite again and enclose between them schists impregnated with iron-pyrite (pyrite) and mispickel (arsenopyrite); in addition to these mineral matters the quartz is mixed with calcite;"

It is likely that several old trenches and pits near the shoreline about 300 m northeast of the above mentioned shaft are the easternmost exposure of this 'vein'. At this location the intermediate metavolcanic

rocks are highly schistose and altered in a zone striking 075° and dipping 70° N, the deformation zone is up to about 10 m wide. It contains locally abundant quartz carbonate veinlets (up to 3 cm wide) and finely disseminated pyrite.

Echo Bay Occurrence (No 2)

A 22 m adit and some trenches were excavated on the north side of Echo Bay around 1895 by Mr. Kendall and Mr. Whiting (Davies and Smith, in prep.). From 1979 to 1983 Tasu Resources Limited conducted geochemical, geophysical, and geological surveys; trenching and channel sampling; and diamond drilled 3 holes with a total length of 315 m in the vicinity of the adit.

The geology of the area is displayed on Figure 14 and has been reinterpreted after work by Tibbo (1980). Easterly striking mafic metavolcanics with locally preserved pillow selvages underlie the central portion of the area. They have been intruded to the southwest by a metagabbro sill. The Rush Bay Stock intrudes the volcanics to the north. In the northernmost portion it consists of plagioclase and alkali feldspar porphyritic quartz monzodiorite. South of this is fine-grained pink felsite which appears to rim the quartz monzodiorite in the southern and western portions of the stock. The area occurs within a zone of moderate to high ductile deformation within the Crowduck Lake - Witch Bay Shear Zone. As a result all rock types are moderately to highly schistose and locally carbonatized and/or

sericitized or chloritized. Foliations trend east to northeast and dip steeply to the north.

The main mineralized zone occurs within the intermediate volcanic unit. The adit cross cuts highly schistose and deformed - intermediate fragmental rocks which strike between 065° and 080° and dip steeply north. Anomalous gold values occur in widths of up to at least 20 metres in the vicinity of the adit in carbonatized and locally pyritized and silicified schists. The zone appears to be lenticular and has been traced by trenching striking northeast are a length of 160 m (see figure 14). A geochemical survey indicates the mineralized zone may be up to about 460 m long (Tibbo 1980). Silicification consists of discontinuous quartz veinlets up to 15 cm wide. Weakly disseminated pyrite is ubiquitous in the mineralized zone and locally concentrated in lenses up to 50 cm wide. Free gold has been noted in some of the quartz veins along with pyrite, and galena (Beard and Rivett 1981).

Channel sampling by Tibbo returned the best results from the adit and the trench immediately above it (Figure 14). Reported values from the adit range up to a maximum of 0.17 ounce gold per ton over 1.8 m and from the trench above the adit 0.106 ounce gold over 4.4 m or 0.148 ounce gold over 1.8 m (Tibbo 1980). .PA

Diamond drilling intersected an anomalous zone beneath the adit (DDH#1 - Figure 14) over a width of 24.4 m with values up to a maximum of 0.074 ounce gold per ton

over 0.9 m. A hole drilled northwest of the adit (DDH#3 - Figure 14) did not intersect any significantly anomalous zones (Tibbo, 1983).

Grab samples of quartz veins with minor disseminated pyrite collected from the adit by members of the 1986 field party contained up to 7520 ppb gold (Table 6, sample 51A).

Echola Occurrence (No 3)

This occurrence consists of an inclined shaft reportedly excavated to a depth of 100 ft (30 m) in 1903 (Beard and Garrett, 1976). It is located about 60 m from the southeast shoreline of the westernmost bay of Ptarmigan Bay.

The shaft was sank on highly strained and sericitized felsic schists with traces of disseminated pyrite about 300 m north of the contact of the Canoe Lake Stock. No quartz vein was observed in outcrop but small quartz veinlets with minor pyrite up to 3 cm thick were observed in the muck pile.

A grab sample of sericitized schist with minor disseminated pyrite was submitted for analysis but did not contain anomalous gold (Table 6, sample 103).

Falconbridge Limited Property (No 4)

This property consists of two separate claim groups. The large group consists of 13 claims (Nos. 850373-79, 882042-44, and 882050-52) and is a portion of a larger group which extends from Squaw Lake to west of the map

area. It is underlain by the Canoe Lake Stock in an area which has been highly fractured, altered and locally mineralized. Cambell (1973) described the mineralization in this area as follows:

> "The copper-molybdenum-zinc mineralization in the Canoe Lake Stock can be classified as porphyry copper type. Although the mineralization is not of ore grade and such a possibility is rather remote, the type of sampling undertaken in the area of highest copper-molybdenum-zinc mineralization and the extent of overburden and water in the area of most concentrated mineral occurrences does not preclude the possibility of the presence of a significant porphyry copper deposit (L. King, personal communication)."

Grab samples of the stock with disseminated sulfides collected from this area by members of the field party ranged up to 590 ppm copper, 30 ppm molybdenum, 70 ppb gold and 10 ppm silver (Table 6, samples 95 to 99).

Ash Bay Occurrence

A second smaller claim group held by Falconbridge Limited consists of 4 claims (855382-85) on the old Ash Bay Occurrence. This occurrence consists of a shaft and several trenches on an island in the northwestern part of Ash Bay. The date of this work is unknown. However, it was done sometime prior to 1935 as Thomson (1937, p. 38) described a visit to the occurrence.

The area is underlain by intermediate fragmental volcanics ranging from tuffs to tuff breccias with intercalated amygdaloidal pillowed and plagioclase phyric intermediate flows to the west. The volcanic rocks are intruded by a thick, locally differentiated mafic sill north of the showings.

Gold and copper mineralization occurs in a quartz vein exposed over a strike length of about 80 m (Figure 15). The vein ranges in width from 10 cm to 50 cm, and in strike and dip from 105¼/55¼ N to 109¼/61¼ N. It consists of white vitreous quartz with minor iron carbonate and thin fractures filled with black tourmaline. Sulphides are minor disseminated pyrite and erratically distributed chalcopyrite up to about 5%. Wallrock is carbonatized and buff weathering for up to 3 m on both sides of the vein.

Thomson (1937) reported an assay value of 0.19 ounce gold per ton from a grab sample of quartz vein "Well-mineralized" with chalcopyrite.

Grab samples of quartz collected by members of the 1986 field party from various locations on the vein (Figure 15) indicate values which ranged from a low of 150 ppb gold and 21 copper to a high of 0.31 ounce gold and 905 ppm copper (Table 6, sample 114 A to D incl.). From these results there appears to be a positive correlation between gold values and copper content.

Geroux Occurrence (No 5)

This occurrence consists of a shallow inclined shaft

and a trench reportedly excavaed around 1895 by A. Geroux (Davies and Smith, in prep.).

The mineralization occurs in a easterly striking, fine-to medium-grained, magnetitic, mafic sill which is about 100 m thick. A well preserved cross-section about 350 m west of the shaft indicates differentiation from melagabbro in the north to quartz gabbro in the south indicating tops to the south. The sill is intruded into variolitic pillowed, aphyric, mafic flows to the north and intermediate plagioclase phyric pillowed flows to the south.

The mafic intrusion is strongly carbonatized in the vicinity of the shaft, locally with abundant fine-to medium-grained magnetite.

A vein striking 076¼ and dipping 57¼ N was observed in the west wall of the shaft. It pinches and swells from 5 to 30 cm thickness in this wall and down to about 3 cm in the east wall. It was not observed in the 10 m long trench to the east of the shaft which extends to the shoreline. The vein consists of white medium-grained sugary quartz and iron carbonate with minor fine-grained disseminated pyrite.

A grab sample of quartz from the shaft collected by members of the 1986 field party and submitted for analysis yielded 110 ppb gold (Table 6, sample 112A).

A small open cut was observed along the shoreline about 500 m southwest of the shaft. A quartz vein at this locality ranges from 5 to 30 cm in width and strikes 128¼ with a dip of 36¼ SW. The quartz is white with minor

iron carbonate, pyrite and chalcopyrite. A grab sample of this vein was analysed and yielded 910 ppb gold (Table 6, sample 110).

Homestake Mineral Development Company Property (No. 6)

This company presently holds 92 claims (nos. 803606 to 803698 inclusive) within the map area. The claims extend east-west along the Crowduck Lake - Witch Bay Shear Zone. In 1985 an airborne geophysical survey was conducted over the claims and the surrounding area. The survey consisted of very low frequency electromagnetics, total field magnetics and gradiometer magnetics (the gradiometer survey was not filed for assessment credit).

A wide variety of rock types are covered by the claim group with the main feature being a broad easterly trending zone of moderately to highly schistose rocks located along the Crowduck Lake - Witch Bay Shear Zone.

Several Mineral Occurrences are located within the claim group and are described separately below.

Rush Bay Occurrence

An adit about 12 m long extends south from the shore in Rush Bay (Claim No. 803697). This adit was not reported on any previous geological maps of the area. The adit is in carbonatized and sericitized schist with medium to coarse-grained augen of alkali feldspar. The schist is derived from alkali feldspar porphyritic quartz monzodiorite of the Rush Bay Stock. The adit is situated about 100 m south of the contact with carbonatized and

sericitized intermediate metavolcanics, all occurring within a zone of relatively intense ductile deformation associated with the Crowduck Lake - Witch Bay Shear Zone. A member of east-west trending quartz veins up to 30 cm thick were observed in the walls of the adit. Near the end of the adit 2 short crosscuts trend to the east and west of the adit following a network of small milky white quartz-carbonate veins with minor pyrite and traces of galena. The wallrock is highly schistose and silicified and contains 1-2% disseminated pyrite. Grab samples of a quartz vein and wallrock did not contain anomalous amounts of gold (Table 6, samples 47A and B).

Homestead Occurrence

A 33.5 m deep shaft, at the Homestead Occurrence was excavated around 1900 by J. Gauthier, J. Earngey and Mr. Birbeck (Davies and Smith, in prep.). It is located on the southwest side of the westernmost bay of Ptarmigan Bay (claim no. 803674). The shaft is in cream coloured, very fine-grained, highly siliceous tuffs and lapilli tuffs with a foliation trending 103½/85½ N. Alteration consists of localized carbonatization and pervasive silicification. Traces of disseminated pyrite were noted in the felsic volcanics but no quartz vein was observed. A grab sample of silicified felsic volcanic with minor pyrite did not contain anomalous amounts of gold (Table 6, sample 107).

Hudson Bay Exploration and Development Company Limited

(1975) (No 7)

In 1975, 6 diamond drill holes with a total footage of 684 ft. were drilled from the ice southwest of Zig Zag Island. The holes were probably drilled to test conductors located in a large scale airborne geophysical survey flown in 1972 (not submitted for assessment credit).

The holes intersected intermediate to felsic metavolcanics with locally intercalated graphitic schist and mineralized zones with up to 20% disseminated pyrite and/or pyrrhotite, and traces of chalcopyrite and sphalerite. No assays were reported.

Inglis Lake Occurrence (No 8)

This occurrence is also known as the William's Option and the J.H.C. Waite Option. It consists of numerous small trenches east of the southeast corner of Inglis Lake about 1 km west of the Kenricia Mine (just east of east boundary of the map area). The trenches were excavated and a vein channel sampled in 1936 (Burton and Carufel 1936) under an option by J.H.C. Waite (Thomson 1937, p. 36). The occurrence was included in a large claim group surrounding the Kenricia Mine held by Atikwa Resources Incorporated and was geologically mapped and prospected by Blakley and MacMillan (1983).

The area is underlain by easterly striking intermediate debris flows which consist of subangular to subrounded heterolithic clasts ranging from tuff breccia to lapilli tuffs and fine-grained tuff. These rocks are

moderately foliated with an easterly strike and steep northerly dip. The vein occurs in a pronounced east northeast trending depression about 50 m wide. The depression extends to the east and west of the vein. It has been traced over a total distance of about 1.5 km and is interpreted as the locus of a fault zone (Blakley and MacMillan 1983).

The quartz vein has been exposed by trenching over a total length of about 100 m (Figure 16). The attitude of the vein ranges from 069½/86½ S to 079½/88½ S. It varies in width from 2-68 cm and occurs in intermediate volcanics which are fine-grained and highly schistose for up to 1.2 m on either side of the vein. This zone of schistosity continues without an accompanying quartz vein west of the trenches and the vein dissappears under heavy overburden to the east.

The vein consists of white to vitreous quartz with varing amounts of black tourmaline and carbonate, and minor to moderate amounts of pyrite. Galena and chalcopyrite, and small particles of visible gold have also been reported (Burton and Carufel 1936).

Lateral offsets of the vein of up to 5 m between trenches D and F (Figure 16) are probably due to dextral displacement on north northwest trending faults.

The vein was channel sampled by Burton and Carufel (1936) with the following summary of results:

> "The vein was channel sampled in several places but values proved to be disappointingly low. Particular attention was given to a favourable

appearing section near the east end of the vein and this section was sampled at intervals of 10 feet or less for a distance of 55 feet. Four samples in a length of 20 feet assayed $12.95 (0.37 ounce gold per ton) across 38 inches, $13.30 (0.38 ounce gold per ton) across 36 inches, $4.90 (0.14 ounce gold per ton) across 36 inches, and $5.60 (0.16 ounce gold per ton) across 19 inches, but values in the remaining distance averaged less than $1.00 (0.03 ounce gold per ton) (Gold valued at $35.00 per oz.)"

Grab sampling by members of the field party indicated values of up to 0.60 ounce gold per ton in quartz with tourmaline and pyrite and 1360 ppb gold in pyritized wallrock adjacent to the vein (Table 7).

Kerr Addison Mines Limited (1971) (No 9)

In 1971, Kerr Addison Mines Limited diamond drilled nine holes in the map area for a total length of 807 metres. Six of the holes were drilled on the central portion of Corkscrew Island (a seventh is indicated on OGS Data Series Map P 2098, but no log was located for this hole in the assessment files).

An additional three holes were drilled from the ice: one southwest of Corkscrew Island; another north of the northeastern tip of Copper Island; and a third south of the northeastern portion of Zig Zag Island. The holes were probably drilled to follow up airborne and/or ground electromagnetic anomalies (not filed for assessment

credits).

The holes intersected felsic to mafic pyroclastic rocks and flows. In some of holes volcanics are intercalated with argillaceous to arenaceous interflow sediments.

Assays from several holes indicated trace amounts of gold, silver, copper, and zinc in a zone with graphite and up to 25% disseminated sulphides. The highest assays are from the northernmost hole drilled on Corkscrew Island. The mineralization occurs in wacke interlayered with felsic volcanics. The zone consists of 18 m of disseminated sulphides with an average content of 10-20% pyrrhotite and pyrite, minor chalcopyrite and sphalerite, and traces of galena. Gold values ranged from trace up to a maximum of 0.04 ounce per ton, silver up to 0.04 ounce per ton, copper up to 0.94% and zinc up to 1.20% (RGFK).

Manitoba Consolidated Occurrence (No 10)

A 75 foot (23 m) shaft was sunk at this location in 1884. The area is underlain by intermediate amygduloidal flows and tuff breccias. In the vicinity of the shaft the rock is highly strained with abundant carbonate and hematitic staining and up to about 1% finely disseminated pyrite cut by quartz-carbonate veinlets.

No vein was visible at or around the shaft, nor was one observed by Coste (1885) when he visited the property while the shaft was being excavated. A grab sample of chloritized wallrock with disseminated pyrite contained

only 15 ppb gold (Table 6, sample 23).

Noranda Exploration Company Limited Property (No 11)

This company currently holds 8 claims in the map area in 3 different locations: The largest claim group consists of 4 claims (Nos 939626 to 939629 incl.) northeast of Echo Bay covering the old Nonesuch and Gauthier Occurrences; another two claims (nos. 896174 and 939630) are located west of Ogawa Bay covering an old shaft and several pits covering a large gossan zone; the third claim group consists of two claims (nos. 928131 and 928132) south of Echo Bay. They are part of a larger group (5 claims in total) located around the Standard Occurrence situated just west of the map area (Beard and Garratt 1976).

Nonesuch Occurrence

The shaft at the old Nonesuch Occurrence was excavated to a depth of 21 m by 1895 (Coleman, 1896, p. 252). The shaft occurs on the eastern tip of a small island (old Mining Location M12) and is currently covered by a wooden deck belonging to a cottage owner who holds the surface rights to the property. The shaft occurs near the contact between easterly striking highly schistose intermediate volcanics and a large mafic intrusion to the south. Just south of the shaft on the shoreline are magnetic, talc-chlorite-carbonate schists which are probably sheared ultramafic intrusive rocks. An alkali feldspar and quartz porphyry dike up to 3 m

wide occurs at the contact striking 075½ with a dip of 70½ N. The shaft was sunk just north of the porphyry dike which at this location contains abundant quartz-carbonate veinlets.

Coleman (1896, p. 252) was informed by the owner of the property that "At 60 ft (18 m) from the surface, a crosscut was made showing the width of the vein to be 45 feet (14 m), with granite footwall, the hangingwall is schistose slate. From 500 to 600 tons were mined, assays varing from $6 to $60 per ton", (gold at $20 per ounce). Grab samples of vein material from the dump and wallrock to the north and south of the shaft collected by members of the 1986 field party did not indicate significant gold values (Table 6, samples 56 B, C and D).

A grab sample from irregular calcite veinlets with localized concentrations of chalcopyrite and galena in talc-chlorite schist from the shoreline south of the shaft contained 125 ppb gold, 24 ppm silver, 1390 ppm copper and 1.27% lead (Table 6, sample 56A).

Gauthier Occurrence

The old Gauthier Occurrence consists of numerous trenches along the shoreline about 700 m southwest of the Nonesuch Shaft (claim no. 939626); and an old inclined shaft about 600 m south of the Nonesuch Shaft (claim no. 939627). The shaft is estimated to be 5-10 m deep and was probably excavated around the turn of the century. It is in massive gabbro which is moderately schistose and carbonatized in the vicinity of the shaft. No quartz

vein was observed. A grab sample of sheared and carbonatized gabbro collected by members of the 1986 field party did not contain anomalous gold (Table 6, sample 58).

The trenches on claim no. 939626 were excavated and sampled by Sylvanite Gold Mines Limited in 1944. Two short holes were diamond drilled beneath one of the trenches by Hoffawes in 1949. From 1979 to 1982, Tasu Resources Limited conducted geochemical, geophysical and geological mapping which included the trenched area (RGFK).

Geology of the trenched area is shown on Figure 17. The area is mostly underlain by highly schistose and carbonatized intermediate fragmental volcanics and interbedded fine-grained sediments. The sediments consist predominantly of cherty siltstones and/or argillites with a minor around of fine-grained wackes in the southwest. Bedding strikes northeast with steep dips to the southeast. In one locality preserved flame structures indicate tops to the southeast. These supracrustal rocks are cut by a massive, medium-grained, magnetic, gabbro intrusion in the northwest and also a large mafic sill to the east and south (not shown on Figure 17). The area lies within the Crowduck Lake - Witch Bay Shear Zone and thus finer-grained protoliths such as volcanics and sediments are highly schistose and locally strongly carbonatized and/or sericitized and silicified.

Gold mineralization occurs in highly schistose zones

in all rock types and is typically accompanied by pervasive silicification and quartz-carbonate veining, pervasive carbonatization, sericitization and up to 5% finely disseminated pyrite.

Twelve trenches were excavated and channel sampled by Sylvanite Gold Mines in 1944 (RGFK) to test the validity of assays from a previous sampling program. The two programs took a total of 84 samples; 32 reported trace gold, while 52 reported values ranging from 0.01 to 0.3 ounce gold per ton over 0.9 m lengths. The longest trench averaged 0.06 ounce gold per ton over 9.6 m, including 0.1 ounce gold per ton over 3.0 m (Tibbo 1982).

Two diamond drill holes drilled at azimuths of approximately 180½ to one another beneath one of the trenches intersected a mineralized zone which assayed $5.90 over 7 feet (0.17 ounce gold per ton over 2.1 m) in one holes and $2.80 over 7.6 feet (0.08 ounce gold per ton over 2.3 m) in the other hole (Tibbo 1982).

The location of grab samples collected by members of the 1986 field party are shown on Figure 17. Samples of silicified and/or pyritized intermediate volcanics ranged up to 8000 ppb gold and indicate anomalous gold values over a large area (Table 6, samples 57 C to 57F incl.). Samples of pyritized and silicified gabbro ranged up to 800 ppb gold (Table 6, samples 57A and B).

Ogawa Bay Occurrence

An old shaft estimated to be at least 15 m deep and several pits were excavated around the turn of the

century on a large gossan zone west of Ogawa Bay (in the north part of claim no. 896174). The gossan is poorly exposed in the shaft and pits. It appears to be up to 30 m wide and consists of disseminated to massive medium-grained pyrite and quartz in schistose and carbonatized intermediate pyroclastic rocks cut by quartz - feldspar porphyry dikes. Three grab samples of massive pyrite and quartz collected by members of the 1986 field party contained up to 22 ppb gold and 13 ppm silver (Table 6, samples 106A, B and C).

G. Pogson Property (Three Friends Occurrence) (No 12)

This property consists of a group of 21 claims (nos. 856186-87, 881836-41, 882174-80, 885746-49, and 885759) located on the northwestern part of Zig Zag Island. The claims cover four shafts, an adit, and numerous trenches and pits which are collectively known as the Three Friends Occurrence.

The property was originally worked in 1890 (Blue 1896) and it was during this early period that most of the development work was done. Thomson (1937, p. 30) indicates that the property was acquired by the Clearwater Bay Syndicate but does not mention if any work was done by this organization. In 1981, Denison Mines Limited conducted ground geophysical, geochemical and geological surveys on the property (RGFK).

The property is underlain by intermediate, plagioclase phyric, pillowed flows and pillow breccia striking east northeasterly. Pillow tops indicate the

intermediate flows are overlain by debris flows with heterolithic volcanic clasts to the north (Figure 18). Aphyric mafic flows occur in the southern portion of the property. A structural interpretation based on top reversals in the region indicate an anticline trending east northeast in the intermediate volcanics and thus the mafic volcanics to the south also overlie the intermediate flows. The volcanics are cut by minor quartz - feldspar porphyry intrusions.

The main mineralized zone is intermittently exposed over a strike length of about 1150 m (Figure 18). It consists of discontinuous lensoidal quartz veins striking east northeast up to about .60 cm thick in zones of highly schistose and altered metavolcanics with disseminated sulphides. The zones are about 3 m wide. The main mineralized zone is more or less restricted to the intermediate flow unit and strikes roughly parallel to the contact with the intermediate fragmental unit to the north. An offset of the main vein between Shaft No 1 and 2 is probably best explained by right-lateral displacement on a north-trending fault, (Figure 18).

A second quartz vein which ranges up to 90 cm wide is exposed about 75 m south of Shaft No. 2 (Figure 18).

The quartz veins contain varying amounts of carbonate, muscovite, tourmaline, pyrite and arsenopyrite. Wallrock adjacent to veins are carbonatized and/or chloritized and contain various amounts of finely disseminated sulphides.

In general the main vein and associated wallrock are

quite low in gold content. Assays reported by Denison Mines Limited ranged up to a maximum of 0.05 ounce gold per ton (RGFK). This was confirmed by a number of grab samples collected by members of the field party. Most of these samples are below detection limits for gold and silver, with a maximum of up to 2090 ppb gold (Table 8, samples A to O).

A previously unworked, and undescribed mineralized zone was observed along the south shore of the property about 325 m south of Main Zone (Figure 18). It is poorly exposed but appears to consist of a rusty zone with up to 20% finely disseminated arsenopyrite and pyrite cut by thin bluish-grey quartz veinlets. The zone strikes about 080½ and is exposed over a strike length of 5 m and is about 2 m wide. Examination of a polished thin section of the disseminated sulphides revealed arsenopyrite is the dominant sulphide mineral, followed by pyrite (variably altered to marcasite and/or hematite and goethite with traces of sphalerite and chalcopyrite. A grab sample of this material assayed 3830 ppb gold and 7.5% arsenic (Table 8, sample P).

A quartz vein which may be a strike extension of the main vein is exposed near the shoreline about 300 m southwest of the westernmost exposure of the main vein (Map in back pocket). The vein is poorly exposed in a small pit above a 10 m long adit which was apparently driven south from the shoreline in a failed attempt to intersect the vein at depth. The vein in the pit is about 25 cm wide and strikes 095°/85°. It consists of

white quartz with about 5% finely disseminated pyrite and minor arsenopyrite. Thomson (1937) reports a grab sample of mineralized quartz contained 0.01 ounce gold per ton. A grab sample of quartz with pyrite collected by the 1986 field party contained 75 ppb gold (Table 6, sample 17).

J.P. Rapski Property (No 13)

This property consists of a small island in Rush Bay designated as Patented Mining Location M. 11. Near the east shore a small adit (4.6 m long) was driven westward on a vein. It lies about 500 m west of the Nonesuch Shaft (Noranda Exploration Company Limited Property - No. 11). A 'vein' which consists of abundant quartz veinlets in highly schistose and carbonatized intermediate volcanics is exposed in the adit and trench just west of the adit. The vein is up to 60 cm wide and strikes 057° with a dip of 75° NW.

Grab samples collected by members of the 1986 field party contain 415 ppb and 295 ppb gold from the vein in the adit and trench respectively (Table 6, samples 54 A and B).

Selco Exploration Company Limited (1966) (No 14)

Three diamond drill holes were drilled in 1966 on airborne geophysical conductors. Two holes are located on land north of Rush Bay, the third was drilled from the ice just east of Rush Bay.

The 2 diamond drill holes north of Rush Bay intersected intermediate to mafic fragmental volcanics

with intercalations of.PA fine-grained argillaceous to siliceous sediments, locally strongly graphitic and with rounded pyrite nodules. The diamond drill log for the third hole, east Rush Bay, was not found but the Kenora Data Series Map for this area (O.G.S. Map P. 2099) indicates the hole intersected intermediate to mafic fragmental volcanics with intercalations of exhalite. Pyrite, pyrrhotite, graphite sphalerite and trace chalcopyrite are also indicated. Assays were not reported on the diamond drill logs.

Squaw Lake Occurrence (No 15)

This occurrence is also known as the Longe claims (Davies 1978). A claim group was staked by R. Longe, and some trenching was done in 1969. Noranda Exploration Company Limited carried out ground magnetic, electromagnetic and induced polarization surveys in 1970. In 1972, Kerr Addison Mines Limited drilled one hole under the main showing.

The area is underlain by altered tonalite and associated quartz-plagioclase porphyries of the Canoe Lake Stock intruded into mafic volcanics and synvolcanic mafic intrusions to the east of the stock.

Chalcopyrite, pyrite, pyrrhotite and locally sphalerite are concentrated along widely spaced fractures and shear zones. Chalcopyrite is locally altered to malachite. Pyrite and chalcopyrite also occur as minor dissaminations within massive phases of the Canoe Lake Stock. Davies (1978, p. 119) reported "the main showing,

which is about 75 feet (22 m) from the shore of Squaw Lake, consists of a mineralized shear zone in quartz diorite close to the contact with mafic rocks".

King (1972, p. 36) reported that "sampling of the main trench across a width of 16 feet (5 m) by Noranda Exploration Company Limited gave values of 0.44% copper, 0.5 ounce of silver per ton". The Kerr Addison drill hole intersected a 5 foot (1.5 m) section containing 0.63 ounce silver per ton, 0.36% copper and 0.01 ounce gold per ton, a 6.4 foot (2 m) section of relatively unmineralized rock, followed by a 4.7 foot (1.4 m) section containing 0.68 ounce silver per ton, 0.52% copper, and 0.01 ounce gold per ton located vertically below the main trench (Davies 1978, p. 119).

Grab sampling of disseminated and shear zone hosted mineralization along the shoreline of Squaw Lake by the 1986 field party indicated values of up to 590 ppm copper, 10 ppm silver and 70 ppb gold (Table 6, sample 99).

Victoria Island Occurrence (No 16)

Two occurrences of quartz veining with arsenopyrite occur on the north side of Victoria Island. A pit about 3 m by 2.5 m was excavated near the shoreline on the north central part of the Island by Ho Foster in 1900 (Chisholm 1949). A second showing on the northeast tip of the Island was traced by stripping over a length of 46 m in 1949 on claims held by H. Palmason (Chisholm 1949).

The north side of Victoria Island is underlain to

the west by felsic volcanics which are predominantly fine-grained, highly schistose and sericitic tuffs with subordinate tuff breccias and lapilli tuffs in western exposures. The felsic volcanics give way to intermediate tuffs and lapilli tuffs to the south and east. Intermediate pillowed to massive amygdaloidal flows are exposed on the west side of a small bay in the north central part of the Island. On the east side of the Bay a small amount of thinly laminated interflow sediments strike north-northeast with a steep northwesterly dip. These are intruded to the east by a massive, magnetic gabbro to quartz gabbro sill. The sill is up to 200 m thick and strikes parallel to bedding in the sediments. A quartz - plagioclase porphyry about 100 m wide intrudes the intermediate volcanics on the northcentral tip of the Island. A zone of high schistosity and associated sericitization and carbonatization up to several hundred metres wide trends easterly across the north half of the Island. This zone of moderate to intense deformation appears to be an east-northeasterly splay off the main part of the Crowduck Lake - Witch Bay Shear Zone.

The showing with the pit on the northcentral tip of the Island occurs within the quartz-plagioclase porphyry intrusion. It consists of a weak network of subhorizontal and subvertical quartz veins over a width of about 2.5 m. Subvertical veins strike 045¼ with a steep southeasterly dip. Veins consist of grey quartz with localized concentration of up to 20% medium-grained arsenopyrite and minor pyrite.

A grab sample collected by Chisholm (1949) assayed trace gold. A grab sample of quartz with about 10% arsenopyrite collected by members of the 1986 field party contained 120 ppb gold and 3.5% arsenic (Table 6, sample 73A).

The showing on the northeastern tip of the Island occurs within the gabbro sill. It consists of a zone of highly schistose and rusty gabbro that is up to 2 m wide and contains quartz veins up to 30 cm wide. The zone was traced over a strike length of about 46 m (Chisholm 1949). It strikes 050° with subvertical dip. Quartz veins contain ribbons of coarse-grained massive arsenopyrite and minor pyrite and chalcopyrite.

A grab sample of massive arsenopyrite collected by Chisholm (1949) assayed 0.01 ounce gold per ton. A grab sample of quartz with about 20% arsenopyrite collected by members of the field party contained 115 ppb gold and 10.8% arsenic (Table 6, sample 75).

Whiting Property (Unicorn Occurrence) (No 17)

This property consists of patented mining location P 308 on the northwestern part of Zig Zag Island. Work on the property consists of a shaft estimated to be 10 - 15 m deep and reportedly excavated around the turn of the century (Davies and Smith, in prep.), and a small pit located about 800 m west of the shaft near the shore on the southwest tip of the location.

The property is underlain by intermediate, massive to pillowed flows which are locally plagioclase phyric

and amygdaloidal. These interdigitate with massive mafic flows to the west which are overlain to the south by thinly bedded.PA mudstones and siltstones. Bedding strikes easterly with a steep southerly dip.

In the vicinity of the shaft a massive white quartz vein was traced by field party members intermittently over a strike length of about 100 m. The vein strikes from 045° to 065° NW. It ranges from 1-2 m in width. The vein contains various amounts of carbonate and black tourmaline and minor to negligible arsenopyrite. The wallrock is moderately altered to sericite and/or chlorite with some carbonate. The schistosity strikes east-northeast with subvertical dip.

Results of analyses of grab samples collected by the field party are as follows: Quartz with arsenopyrite and tourmaline from the shaft - 825 ppb gold and 2.6% arsenic (Table 6, sample 29A); quartz with arsenopyrite from vein exposed along shoreline about 60 m SW of the shaft - 22 ppb gold and 3400 ppb arsenic (Table 6, sample 28); quartz from vein along shoreline about 40 m NE of the shaft-gold below detection limits (Table 6, sample 30).

The pit on the southeastern tip of the location contains large pieces of quartz float but no vein was exposed, due to the poor conditions of pit at the present time. The size of pieces of quartz float indicate the vein is at least 30 cm wide. Sulphides are locally abundant and consist of arsenopyrite, galena, sphalerite, pyrite and chalcopyrite. Several small quartz veins with minor arsenopyrite are exposed along the shoreline SW of

the pit. They are up to 10 cm wide and strike 060°/65° SE.

A grab sample of quartz float with abundant sulfides was collected by the members of the 1986 field party and contained 155 ppb gold, 7 ppm silver, 1.16% arsenic, 1490 ppm lead, 730 ppm zinc and 81 ppm copper (Table 6, sample 27A). A grab sample of the smaller quartz veins SW of the pit contained 5 ppb gold and 1200 ppm arsenic (Table 6, sample 27B).

A grab sample from this location collected by Thomson (1937, p. 30) assayed 0.02 ounce gold per ton.

Recommendations for Future Exploration

The area described in this report is considered to have potential for economic concentrations of gold. The areas of greatest potential are probably within the Crowduck Lake - Witch Bay Shear Zone and its associated splays.

Many recent studies on 'greenstone' hosted gold deposit in the Superior Province of Ontario have shown these deposits to occur in zones where the rocks have had a high permeability which has been structurally induced relatively late in their development (e.g. Colvine et al. 1984). The deposits occur in fault or shear zones and have broad zones of alteration spatially associated with them.

Gold, however, is not uniformly distributed along zones of deformation and alteration, for example along the Crowduck Lake - Witch Bay Shear Zone.

In this zone, based on empirical evidence there seems to be a good correlation between the locations of gold occurrences and high competency contrast of lithologies. For example mineralization at the Echo Bay Occurrence (No 2), the Gauthier and Nonesuch Occurrences (Noranda Exploration Company Limited - No 11) occurs at contacts of rocks characterized by competency contrast e.g. they occur in highly sheared intermediate volcanics between two large intrusions. The intrusions are the Rush Bay Stock to the north and a large gabbro sill to the south.

Additionally, favourable sites for gold mineralization may occur where there is an abrupt change in the trend of the shear zone. This was observed at the Nor Penn Prospect in the Rat Portage Bay Area east of the present map area (Ayer and Gil 1985) and on the southwestern tip of Corkscrew Island in the present area. The gold mineralization at the Nor Penn Occurrence is in the northern part of the Crowduck Lake - Witch Bay Shear Zone at a point where it is deflected from an easterly to a southwesterly trend. Previously unrecognized gold mineralization also occurs in a similar environment at the southwestern tip of Corkscrew Island. Here foliations in the Crowduck Lake - Witch Bay Shear Zone changes from an easterly to northeasterly trend. Breccia zones up to tens of metres wide occur near the southwest tip of Corkscrew Island and on small islands east and west of the point. Highly altered, angular volcanic fragments occur in a matrix of quartz and carbonate with fine to

coarse-grained pyrite disseminated in the fragments and the matrix. Four grab samples collected by members of the 1986 field party of breccia over a wide area indicated highly anomalous gold values ranging from a low of 360 ppb to a high of 1235 ppb (Table 6, samples 125 to 127).

During the mapping grab samples were collected by members of the field party throughout the map area. Sample locations are indicated on the map face (in pocket) with corresponding assay values and coded information on the nature, width and strike of the sampled zone in Table 6. Many of the assays obtained anomalous values of gold and/or other metals. Some of the sample locations listed in Table are previously unworked and/or unrecognized zones of mineralization and are worthy of more detailed examination.

REFERENCES:

Ayer, J.A.

in press: Geology of the Rat Portage Bay Area, District of Kenora; Ontario Geological Survey, Open File Report.

Ayer, J.A., and Gil, K.M.

1986: Precambrian Geology of Rat Portage Bay, District of Kenora; Ontario Geological Survey, Maps P.2966 and P.2967, Geological Series - Preliminary Map, scale 1:15 840. Geology 1985.

Ayer, J.A., Gil, K.M., and McCurdy, M.

1985: Precambrian Geology of Bigstone Bay, District of Kenora; Ontario Geological Survey, Maps P.2830 and P.2831, Geological Series - Preliminary Map, scale 1:15 840. Geology 1984.

Ayer, J.A., Smith, P.M., and Davies, J.C.

in press: Geology of the Bigstone Bay Area, District of Kenora; Ontario Geological Survey, Open File Report.

Ayers, L.D., and Thurston, P.C.

1985: Archean Supracrustal Sequences in the Canadian Shield: an Overview. Geological Association of Canada, Special Paper 28, p.342-380.

Bateman, P.C.

1961: Granitic Formations in the East-Central Sierra Nevada near Bishop, California; Geological Society of America, Bulletin, Vol. 72, p.1521-1538.

Beakhouse, G.P.

1985b: Geological Relationships in the Vicinity of the Wabigoon-Winnipeg River Interface in the Kenora Area; Institute on Lake Superior Geology, Thirty-first Annual Meeting, Field Trip Guide Book, p.59-103.

Beard, R.C. and Garratt, G.L.

1976: Gold Deposits of the Kenora-Fort Frances Area, District of Kenora and Rainy River; Ontario Division of Mines, Mineral Deposit Circular 16, 46 p.

Beard, R.C., and Rivett, S.

1981: 1980 Report of the Northwestern Regional Geologist and Kenora Resident Geologist; p.1-16 in Annual Report of the Regional and Resident Geologists, 1980, Edited by C.R. Kustra, Ontario Geological Survey Miscellaneous Paper 95, 158p.

Blackburn, C.E.

1981: Kenora-Fort Frances Geological Series: Ontario Geological Survey Map 2443, scale 1:253,440 or 1 inch to 4 miles.

Blakeley, I.T., and MacMillan, D.W.

1983: Report on Geological Mapping, Kenricia Project, Atikwa Resources Incorporated, District of Kenora; Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Kenora.

Burt, D.M., Sheridan, M.F., Bikun, and Christiansen, E.H.

1982: Topaz Rhyolites - Distribution, Origin and

Significance for Exploration; Economic Geology, Vol. 77, p.1818-1836,

Burton, P.R., Carufel, A.O.

1936: Report on the Williams Option, Kenora, Ontario; Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Kenora.

Campbell, I.H., Coad, P., Franklin, J.M., Gorton, M.P.,Scott, S.D., and Thurston, P.C.

1982: Rare Earth Elements in Volcanic Rocks Associated with Cu-Zn Massive Sulphide Mineralization: a Preliminary Report; Canadian Journal of Earth Science, Vol. 19, p.619-623.

Campbell, S.W.

1973: Mineralization in the Canoe Lake Stock, Lake of the Woods - Shoal Lake Area, Northwestern Ontario; Unpublished M.Sc. Thesis, University of Manitoba, 213p.

Chisholm, E.O.

1949: A Short Report on Victoria Island, Lake of the Woods, Kenora MiningDivision, Ontario; Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Kenora.

Clark, G.S., Bald, R., and Ayres, L.D.

1981: Geochronology of Orthogneiss Adjacent to the Archean Lake of the Woods Greenstone Belt, Northwestern Ontario: A Possible Basement Complex. Canadian Journal of Earth Science, Vol. 18, p.94-102.

Coleman, A.P.

1895: Second Report on the Gold Fields of Western Ontario; Ontario Bureau of Mines Report 1895, Vol. 5, p.47-106.

1896: Third Report on the Western Ontario Gold Region; in Ontario Bureau of Mines Report 1896; Vol. 6, p.71-124.

Colvine, A.C., Andrews, A.J., Cherry, M.E., Durocher, M.E., Fyon, A.J., Lavigne, M.J., Macdonald, A.J., Marmont, S., Poulsen, K.H., Springer, J.S., and Troop, D.G.

1984: An Integrated Model for the Origin of Archean Lode Gold Deposits, Ontario Geological Survey, Open File Report 5524m 98p.

Corfu, F. and Stott, G.M.

1986: U-Pb Ages for Late Magmatism and Regional Deformation in the Shebandowan Belt, Superior Province, Canada. Canadian Journal of Earth Science, Vol. 23, No. 8, p.1075-1082.

Coste, E.

1895: Geological and Natural History Survey and Museum of Canada (GSC), Report of Progress 1892-93-94, Report of the Gold Mines of the Lake of the Woods, pt. K.

Davies, J.C.

1965: Geology of the High Lake - Rush Bay Area, District of Kenora; Ontario Department of Mines, Geological Report 41, 57p. Accompanied by Map 2069, scale 1:31 680 or 1 inch to 1/2 mile. Geology 1961, 1962.

1978: Geology of the Shoal Lake - Western Peninsula Area, District of Kenora; Ontario Geological Survey, Open File Report 5142, 131p.

1982: Western Peninsula, District of Kenora; Ontario Geological Survey, Map 2423, Precambrian Geology Series, scale 1 inch to 1/2 mile of 1:31 680. Geology 1968, 1969.

Davies, J.C., and Smith, P.M.

In press: Gold Deposits in the Lake of the Woods Area; Ontario Geological Survey, Open File Report.

Fisher, R.V.

1982: Debris Flows and Lahars, in Pyroclastic Volcanism and Deposits of Cenozoic Intermediate to Felsic Volcanic Islands with Implications for Precambrian Greenstone Belt Volcanoes. Geological Association of Canada, Short Course Notes, Vol. 2, p.136-190.

Goodwin, A.M.

1965: Preliminary Report on Volcanism and Mineralization in the Lake of the Woods - Manitou Lake - Wabigoon region of northwestern Ontario; Ontario Department of Mines Preliminary Report 1965 - 2, 63p.

1970: Archean Volcanic Studies in the Lake of the Woods - Manitou Lake - Wabigoon Region of Western Ontario, Ontario Department of Mines Open File Report, 47p.

Greer, Leonard

1931: Geology of the Shoal Lake (West) Area, District

of Kenora; Ontario Department of Mines, Annual Report for 1930, Volume 39, Part 3, p.42-56. Accompanied by Map 39e, scale 1:63 360 or 1 inch to 1 mile. Geology 1929.

Halls, H.C.

1982: The Importance and Potential of Mafic Dyke Swarms in Studies of Geodynamic Processes, Geoscience Canada, Vol. 9, No. 3, p.145-154.

1986: Paleomagnetism, Structure, and Longitudinal Correlation of Middle Precambrian Dykes from Northwestern Ontario and Minnesota, Canadian Journal of Earth Science, Vol. 23, No. 2, p.142-147.

Hildreth, Wes

1979: The Bishop Tuff: Evidence for the Origin of Compositional Zonation in Silicic Magma Chambers; Geological Society of America, Special Paper 180, p.43-75.

1981: Gradients in Silicic Magma Chambers: Implications for Lithospheric Magmatism; Journal of Geophysical Research, Vol. 86, p.10153-10192.

Jones, V.G.

1969: Pillow lavas as depth indicators; American Journal of Science, Vol. 267, p.181-195.

King, H.L.

1972: Kenora District: Annual Report of Resident Geologist's Section; Ontario Division of Mines, Miscellaneous Paper 50, p.1-36.

Lawson, A.C.

1885: Report on the Geology of the Lake of the Woods Region, with Special Reference to the Keewatin (Huronian) Belt of theArchean Rocks; Geological and Natural History Survey of Canada, Annual Report for 1885, Vol. 1, Part CC, 151p.

Patterson, G.C.

1981: Assessment Report for Claims K575061-3, K560010, 2, and 3, Clearwater Bay, District of Kenora, for Denison Mines Limited; Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Kenora.

Sanborn, Mary

1986: Lake of the Woods Structural Study; p.30-36 in Summary of Field Work and Other Activities 1986, by the Ontario Geological Survey, edited by P.C. Thurston, Owen L. White, R.B. Barlow, M.E. Cherry, and A.C. Colvine, Ontario Geological Survey, Miscellaneous Paper 132, 435p.

Smith, P.M., and Thomas, D.A.

1986: Interrelationship of Gold Mineralization and the Canoe Lake Stock, Northwestern Lake of the Woods Area; p.242-251 in Summary of Field Work and Other Activities 1986, by the Ontario Geological Survey, edited by P.C. Thurston, Owen L. White, R.B. Barlow, M.E. Cherry, and A.C. Colvine, Ontario Geological Survey, Miscellaneous Paper 132, 435p.

Stix, J.

1985: Volcanic Facies and Geochemistry of Archean Lava

Flows and Pyroclastic Rocks Near Kenora, Ontario, Canada; Unpublished M.Sc. Thesis, University of Toronto, 204p.

Streckeisen, A.

1975: To Each Plutonic Rock its Proper Name; Earth Science Reviews, Vol. 12, p.1-33.

Thomson, J.E.

1937: Geology of the North Central Part of the Lake of the Woods, Kenora District, Ontario; Ontario Department of Mines, Annual Report for 1936, Volume 45, Part 3, p.1-43. Accompanied by Map No. 45b, scale 1 inch to 1 mile or 1:63 360. Geology 1935.

Thurston, P.C.

1980: Subaerial Volcanism in the Archean Uchi - Confederation Volcanic Belt. Precambrian Research, Vol. 12, p.79-98.

Tibbo, H.G.

1980: Report on the Results of a Program of Channel Sampling, Humus Geochemistry, and Geological Mapping on Mineral Claims 489739, 40, 45, 46, 47, 48 and 490220 Echo Bay Area, Lake of the Woods, Kenora Mining Division; Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Kenora.

1982: Report on the Results of a Program of Geological Mapping on Mineral Claims 4889739 and 489740 Echo Bay Area, Lake of the Woods Kenora Mining Division; Resident Geologist's Files, Ontario

Ministry of Northern Development and Mines, Kenora.

1983: Tasu Resources Limited, Diamond Drill Logs for Mineral Claims K489747 and K490220, Echo Bay Area, Lake of the Woods, District of Kenora; Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Kenora.

Trowell, N.F.

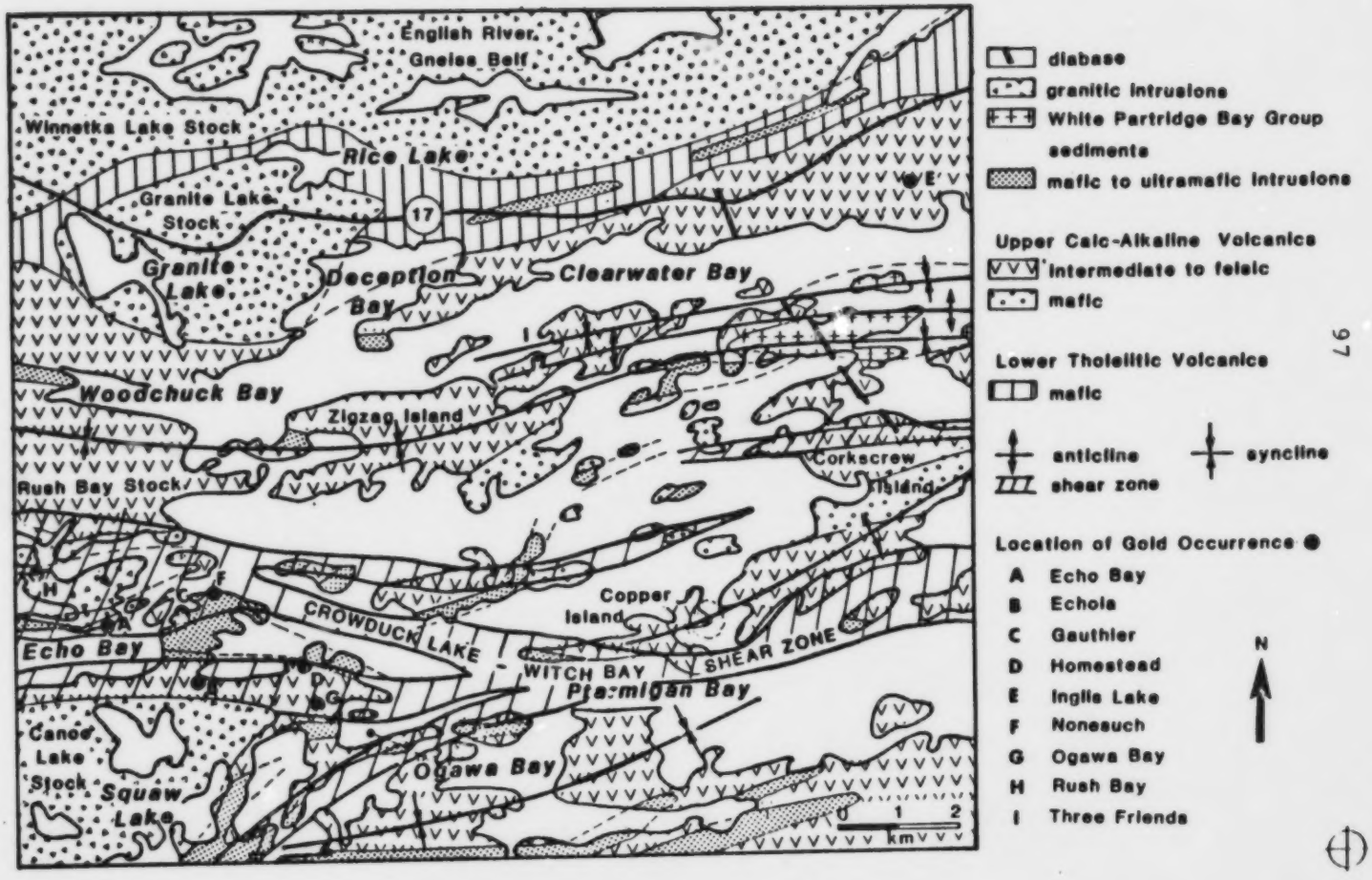
1986: Geology of the Gibi Lake Area, District of Kenora; Ontario Geological Survey, Open File Report 5629, 153p.

Vagt, G.O.

1968: The Tectonic Significance of some Intrusive Rocks in the Kenora - Westhawk Lake Area, Ontario; Unpublished M.Sc. Thesis, University of Manitoba, 78p.

FIGURES

Figure 2: Generalized Lithostratigraphic and Structural Map of the Clearwater Bay Area


English River Gneiss Belt
Winnetka Lake Stock
Rice Lake
Granite Lake Stock
17
Granite Lake
Deception Bay
Clearwater Bay
Woodchuck Bay
Zigzag Island
Corkscrew Island
Rush Bay Stock
Copper Island
CROWDUCK LAKE
WITCH BAY
SHEAR ZONE
Echo Bay
Ptarmigan Bay
Canoe Lake Stock
Squaw Lake
Ogawa Bay
0 1 2 km
diabase
granitic intrusions
White Partridge Bay Group sediments
mafic to ultramafic intrusions
Upper Calc-Alkaline Volcanics
intermediate to felsic
mafic
Lower Tholeiitic Volcanics
mafic
anticline
syncline
shear zone
Location of Gold Occurrence
A Echo Bay
B Echola
C Gauthier
D Homestead
E Inglis Lake
F Nonesuch
G Ogawa Bay
H Rush Bay
I Three Friends
N

97

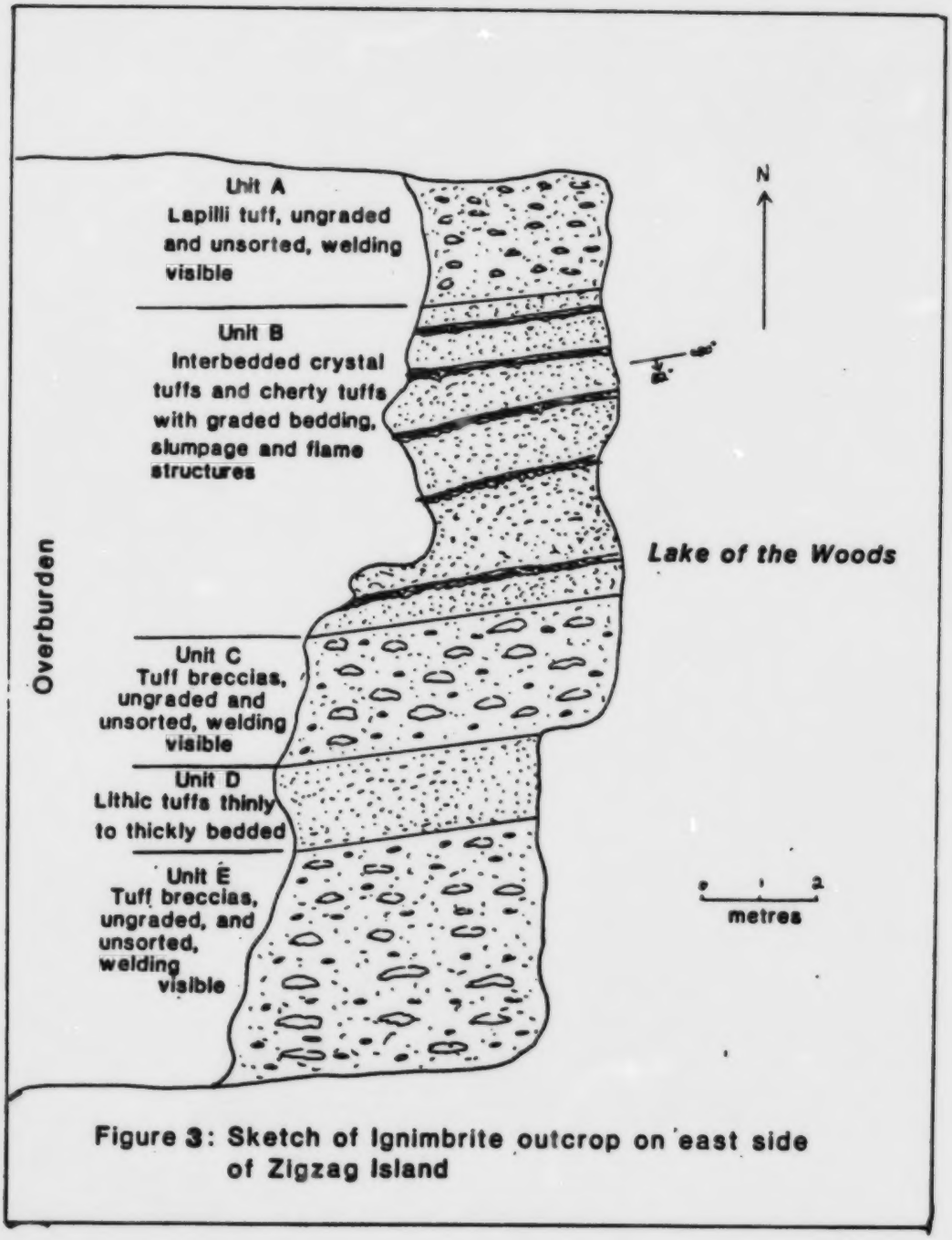
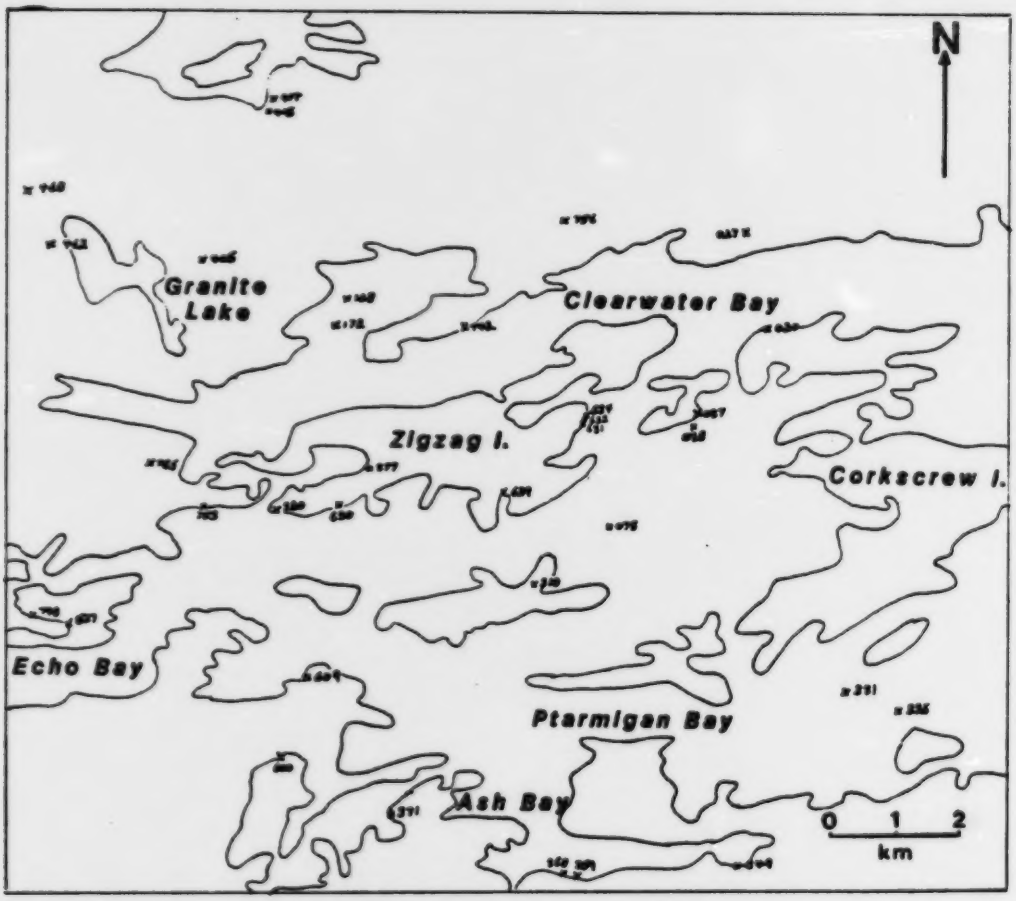


Figure 3: Sketch of Ignimbrite outcrop on east side of Zigzag Island

Figure 4: Sample locations for Analysed Rocks from the Clearwater Bay Area



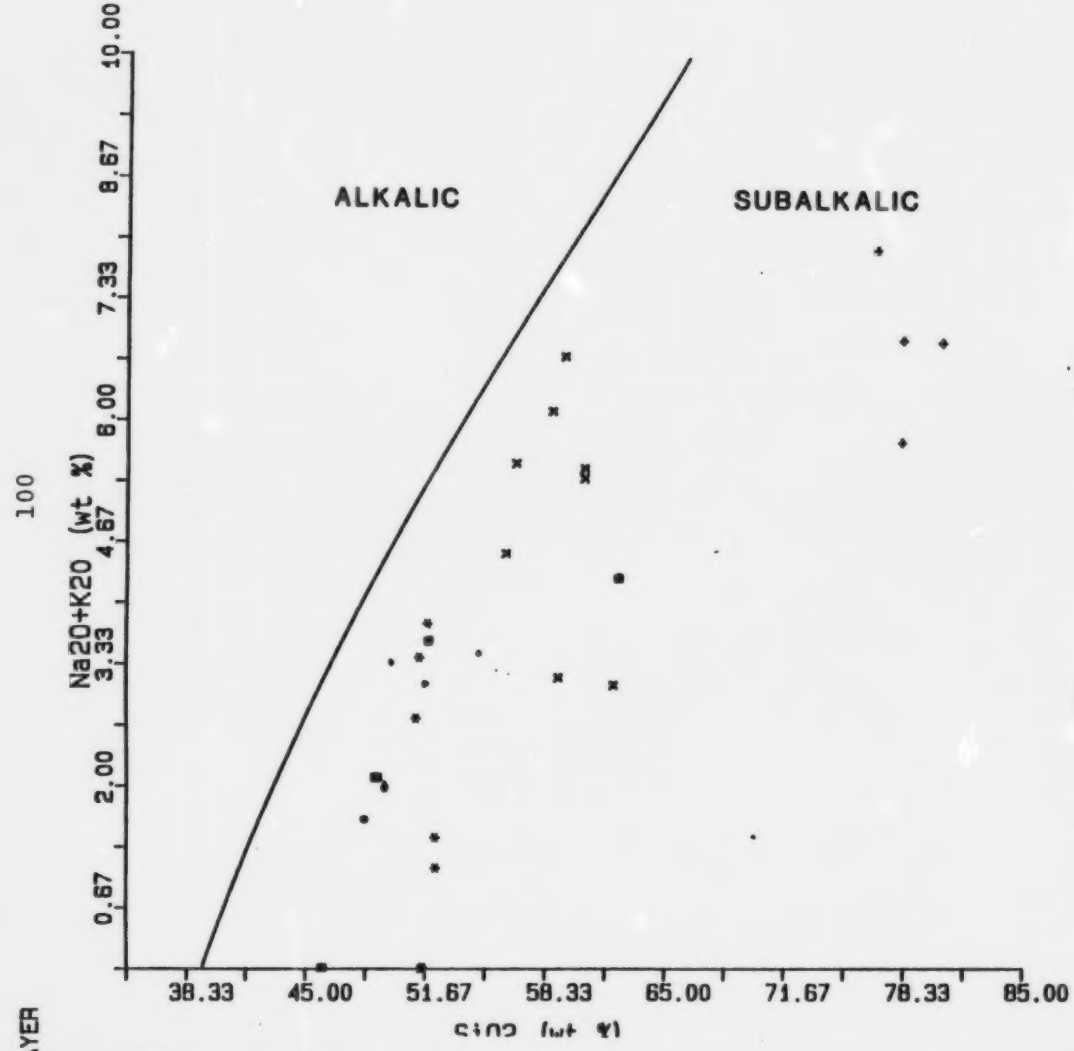


Figure 5: Na_2O+K_2O versus SiO_2 Diagram of Volcanic and Synvolcanic Intrusive Rocks from the Clearwater Bay Area

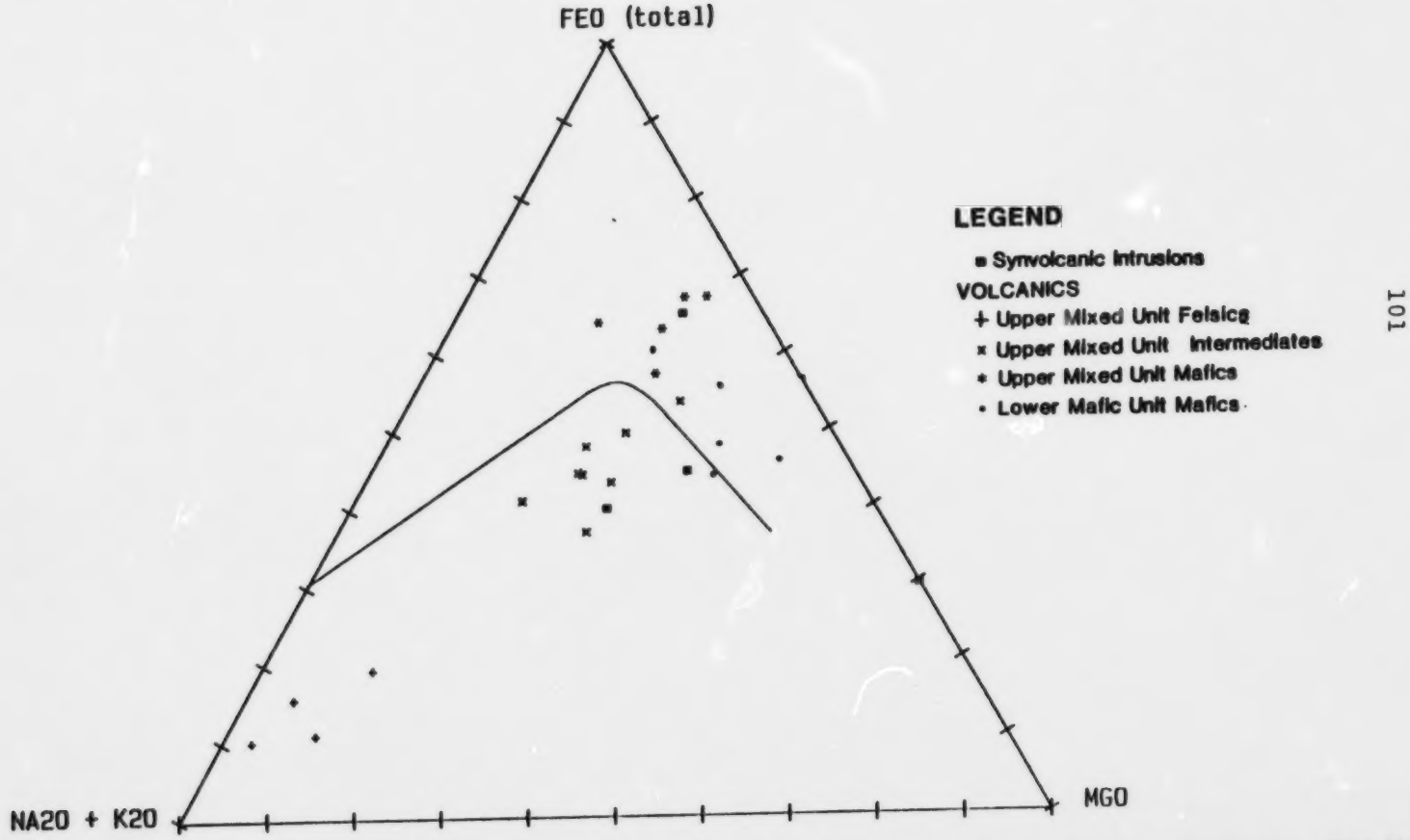


Figure 6: AFM Diagram of Volcanic and Synvolcanic Intrusive Rocks from the Clearwater Bay Area

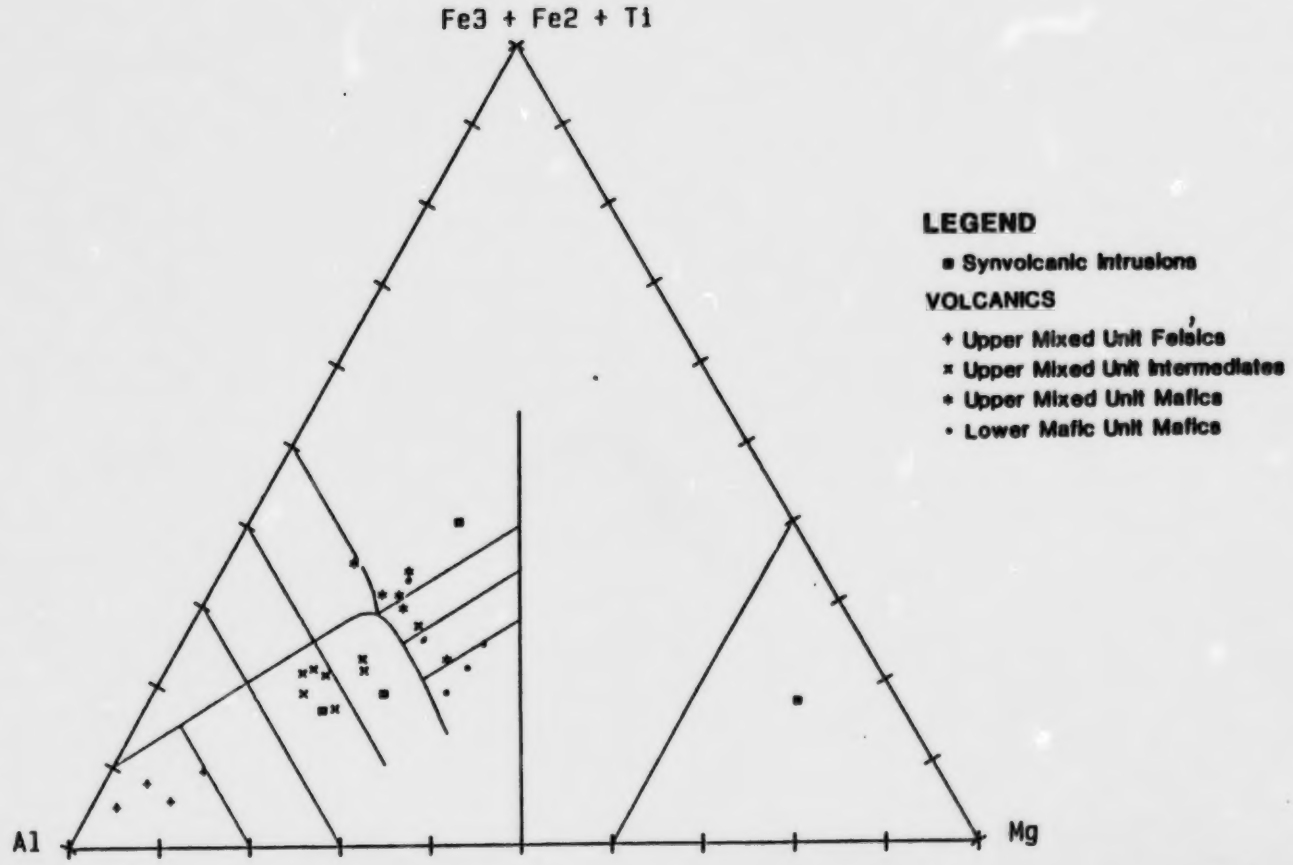


Figure 7: Jensen Cation Diagram of Volcanic and Synvolcanic Intrusive Rocks from the Clearwater Bay Area

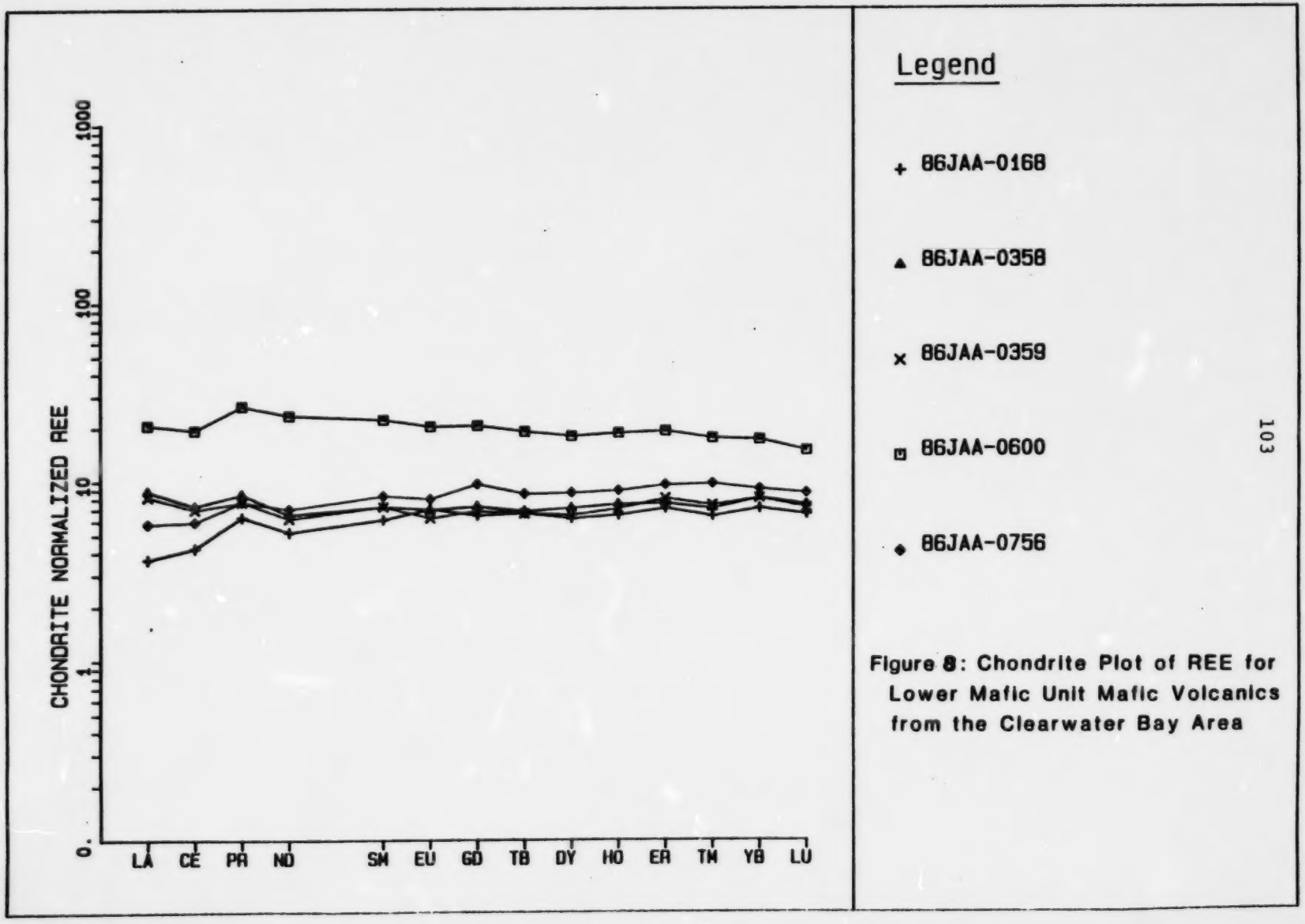
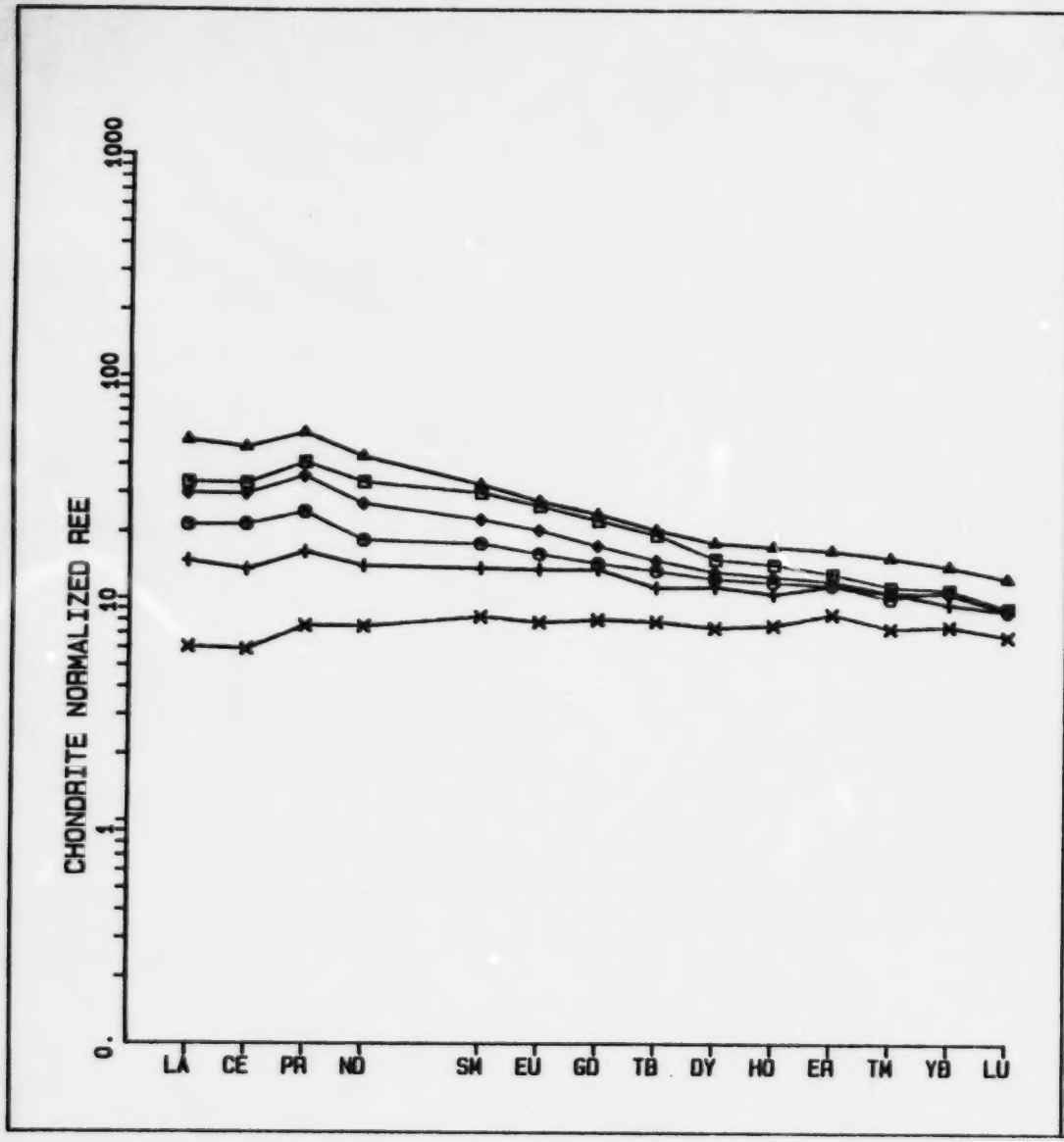


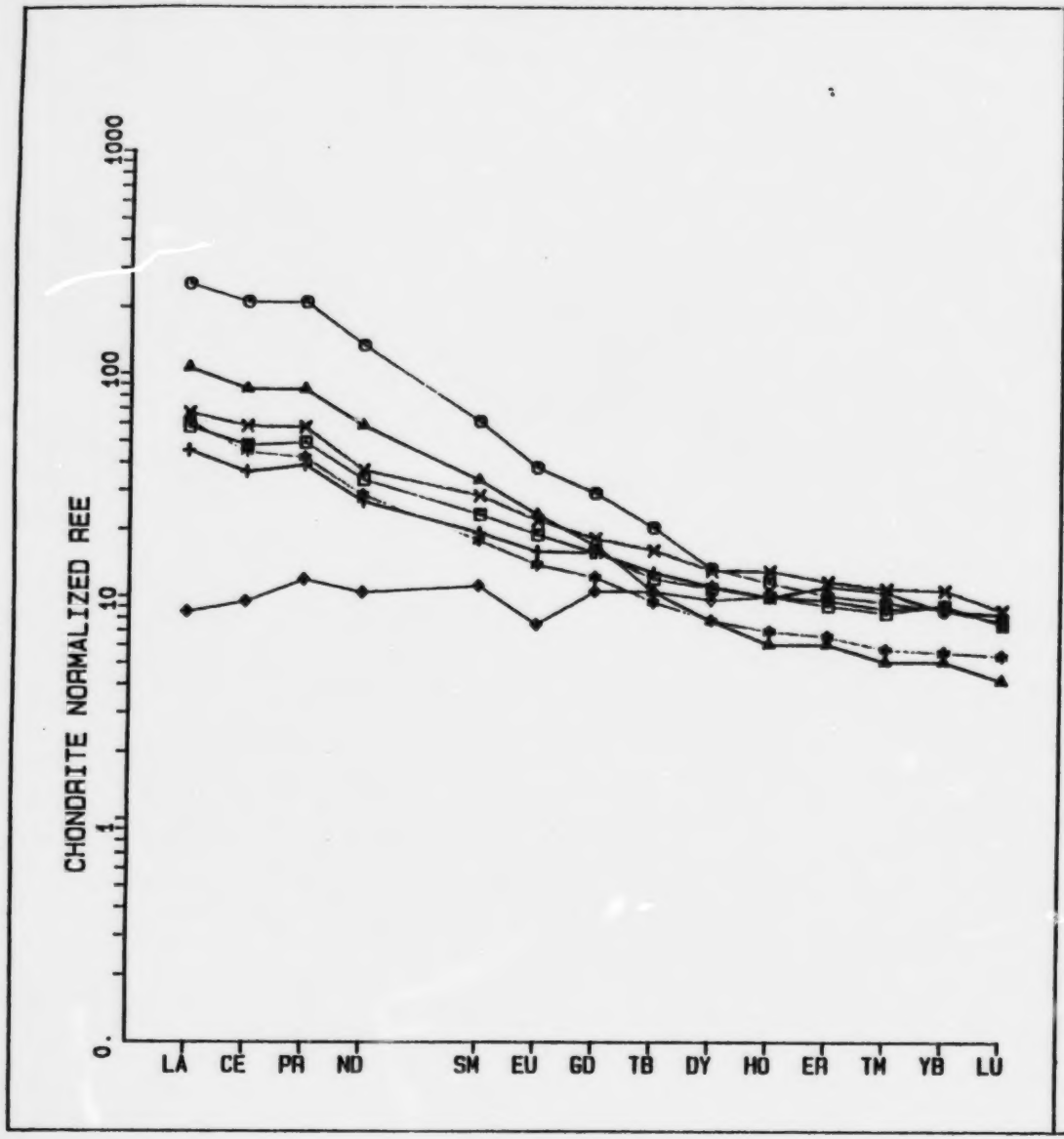
Figure 8: Chondrite Plot of REE for Lower Mafic Unit Mafic Volcanics from the Clearwater Bay Area



Legend

- 86JAA-0037
- 86JAA-0038
- 86JAA-0075
- 86JAA-0172
- 86JAA-0331
- 86JAA-0335

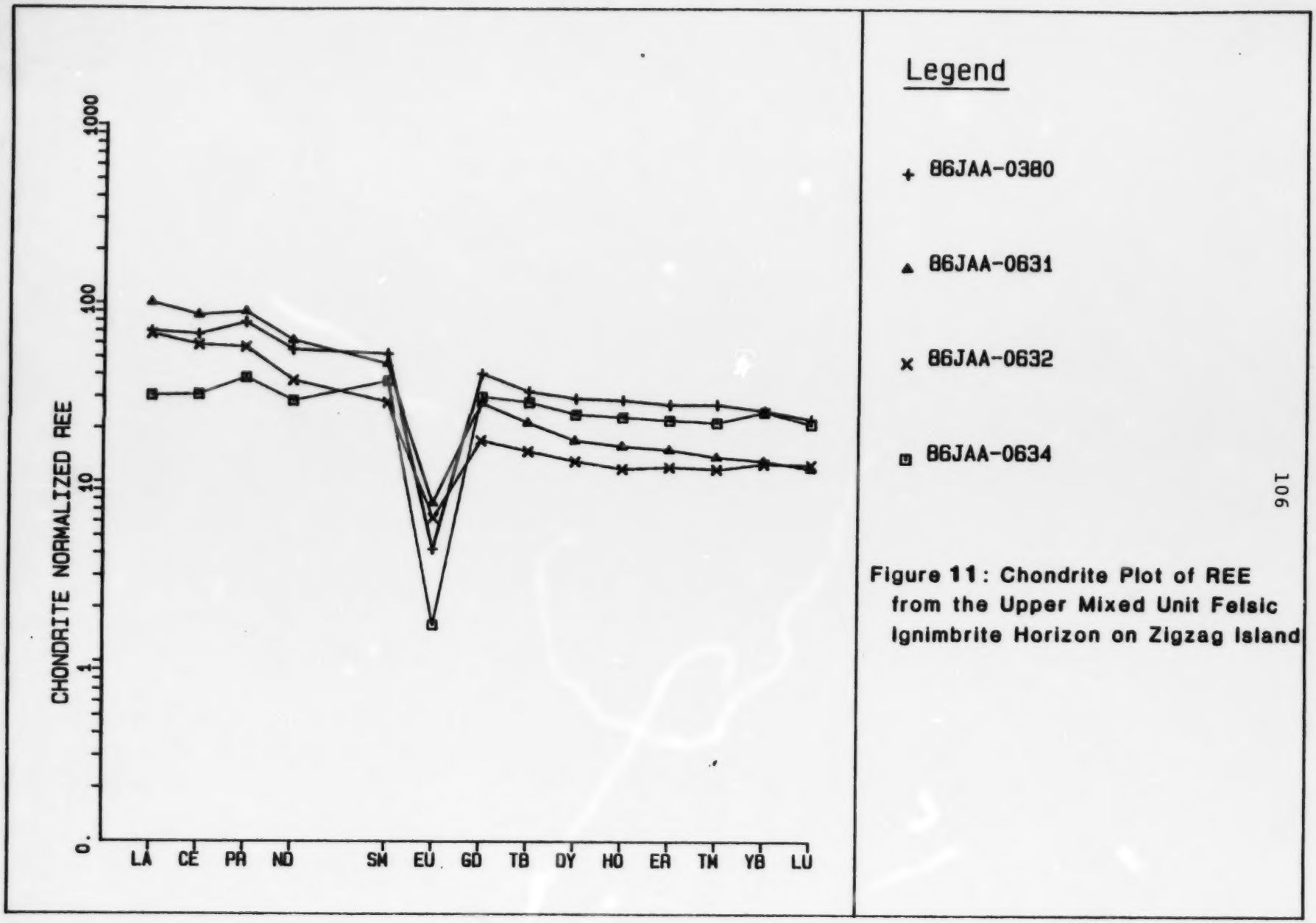
Figure 9 : Chondrite Plot of REE for Upper Mixed Unit Mafic Volcanics from the Clearwater Bay Area



Legend

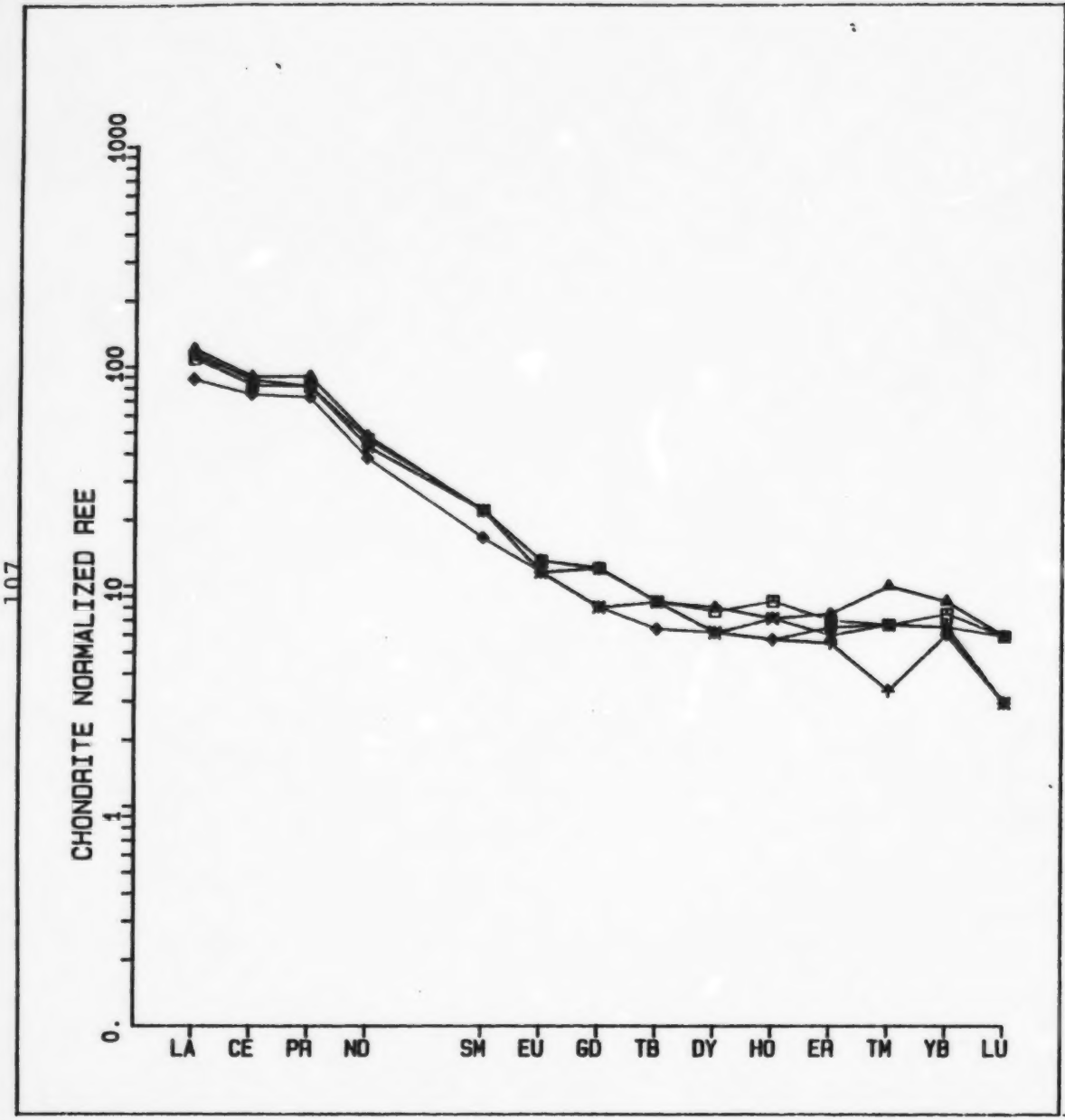
- 86JAA-0020
- 86JAA-0142
- 86JAA-0377
- 86JAA-0629
- 86JAA-0630
- 86JAA-0753
- 86JAA-0755

Figure 10 : Chondrite Plot for REE for Upper Mixed Unit Intermediate Volcanics from the Clearwater Bay Area



106

Figure 11: Chondrite Plot of REE from the Upper Mixed Unit Felsic Ignimbrite Horizon on Zigzag Island



Legend

+ 85JAA-0063

▲ 85JAA-0068

× 85JAA-0074

□ 85JAA-0213

◆ 85JAA-0214

Figure 12: Chondrite Plot of REE for Felsic volcanics from the Rat Portage Bay Area (Ayer, in press)

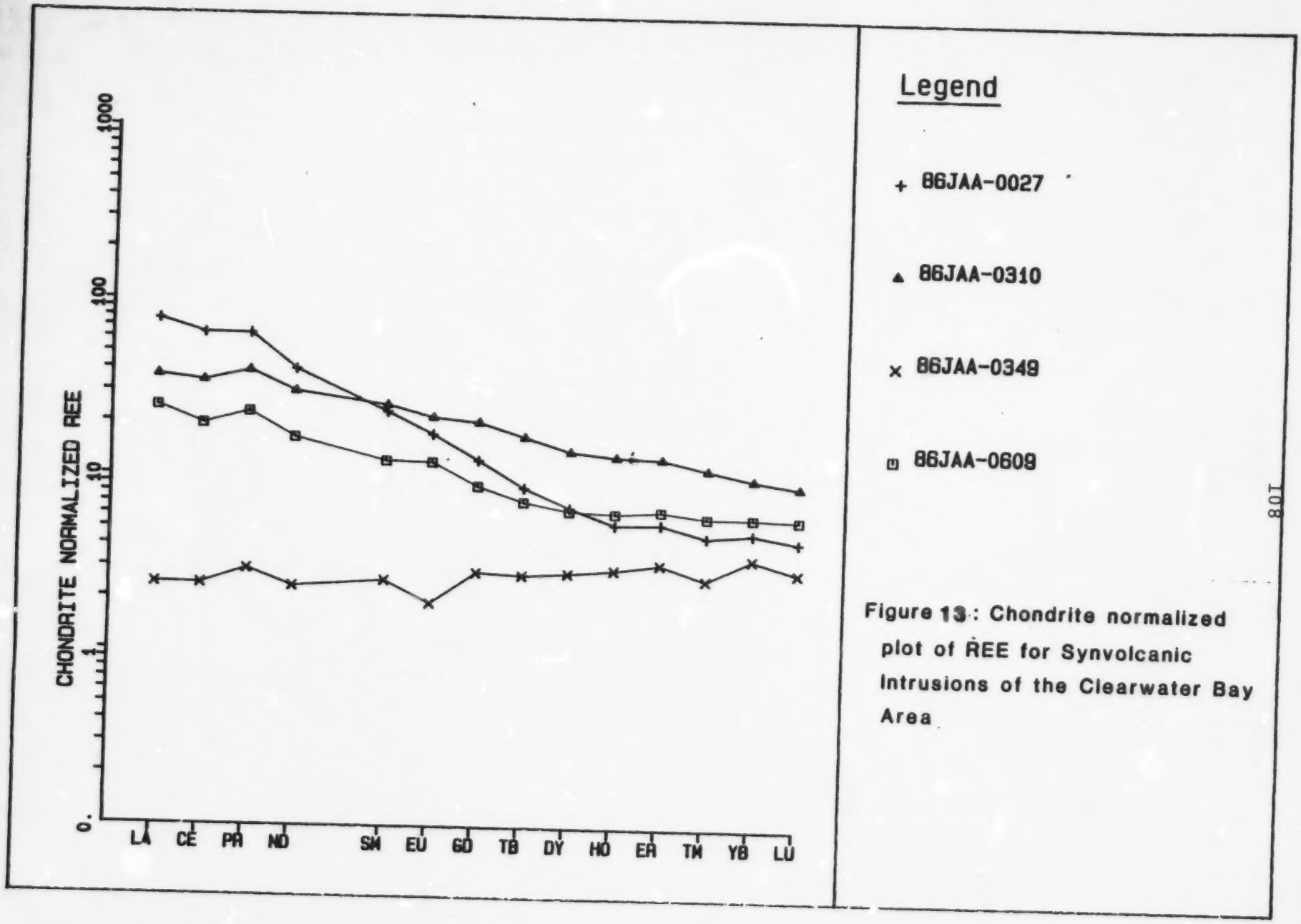
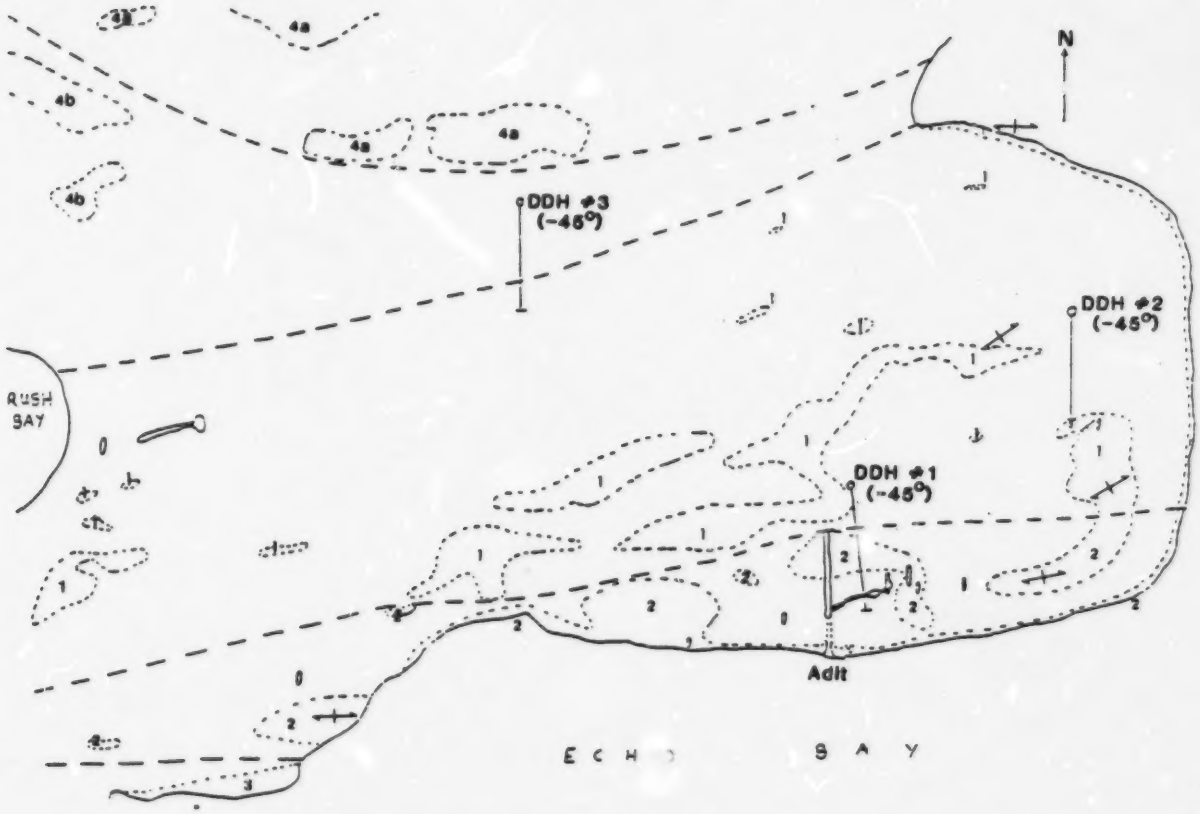


Figure 13: Chondrite normalized plot of REE for Synvolcanic Intrusions of the Clearwater Bay Area

Figure 14 : Echo Bay Occurrence (modified after Tibbo, 1980)



LEGEND

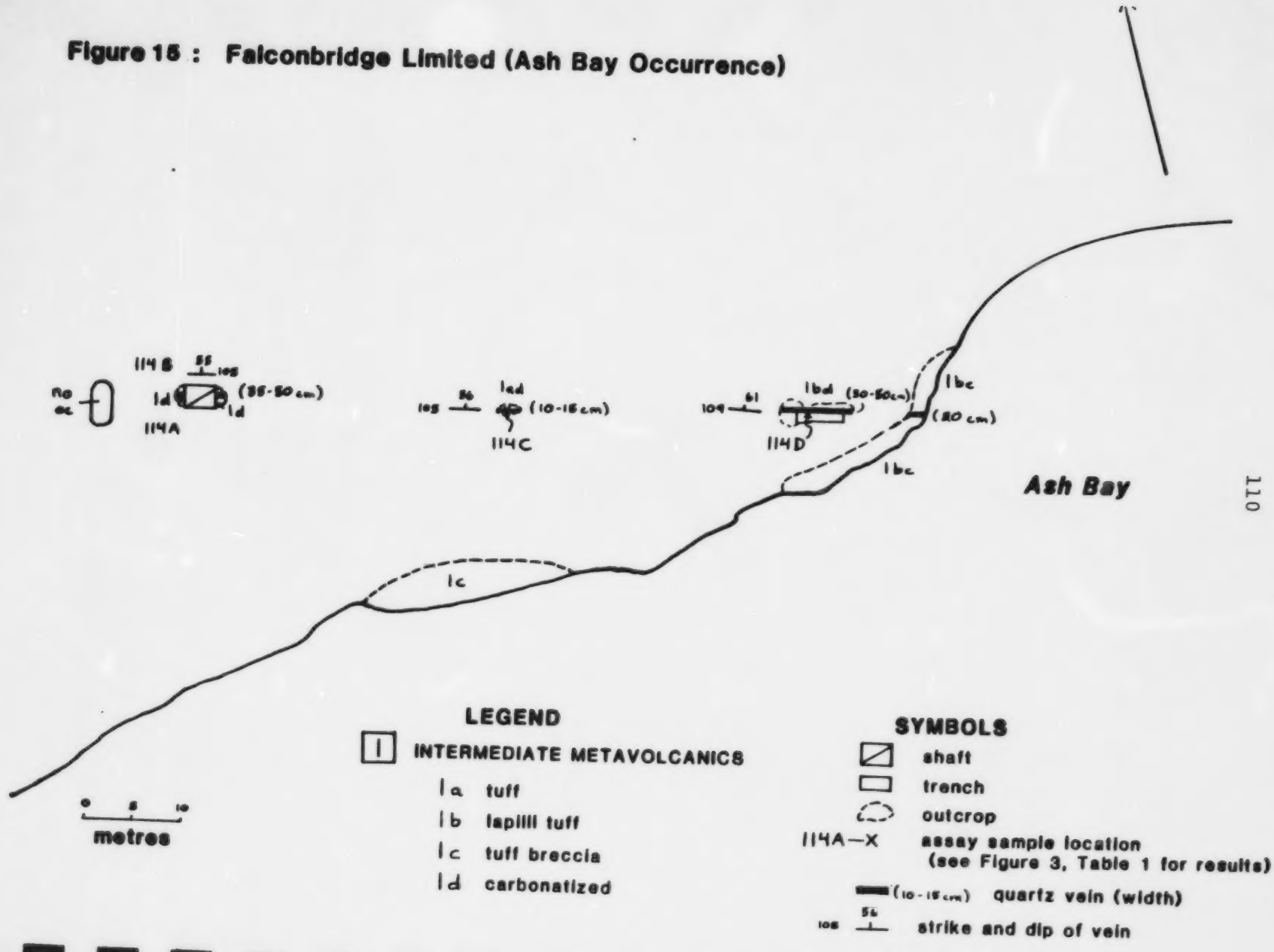
- 4a Feldspar Porphyritic Quartz Monzodiorite
- 4b Felsite
- 3 Gabbro
- 2 Intermediate Fragmentals and Flows
- 1 Mafic Flows

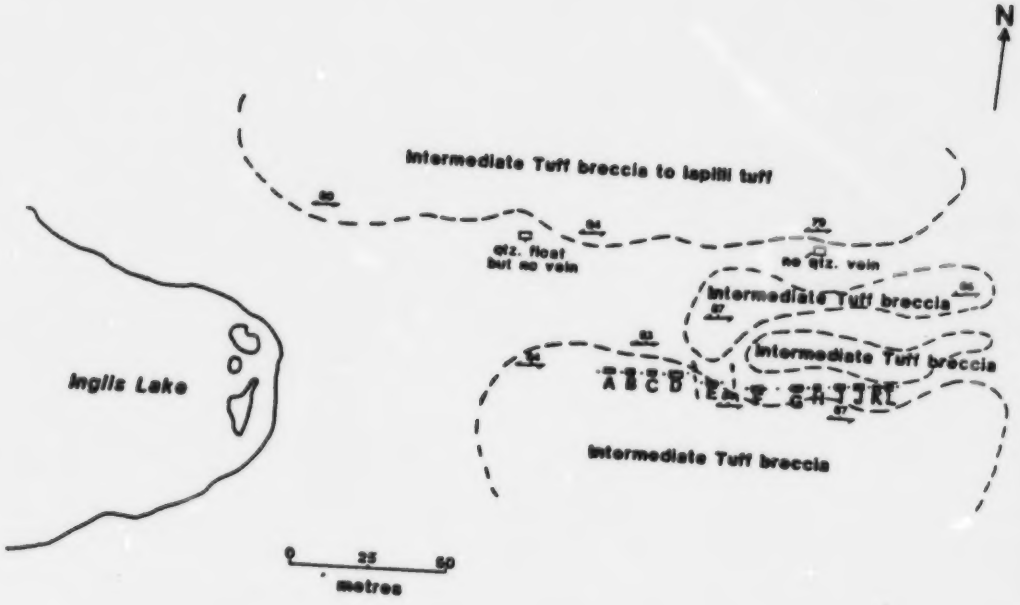
Note: all rocks moderately to highly schistose and locally carbonatized

SYMBOLS

- outcrop/suboutcrop area
- geological contact, inferred
- foliation, dip vertical
- trench or pit
- adit portal
- diamond drill hole (inclination) projection to surface

Figure 15 : Falconbridge Limited (Ash Bay Occurrence)

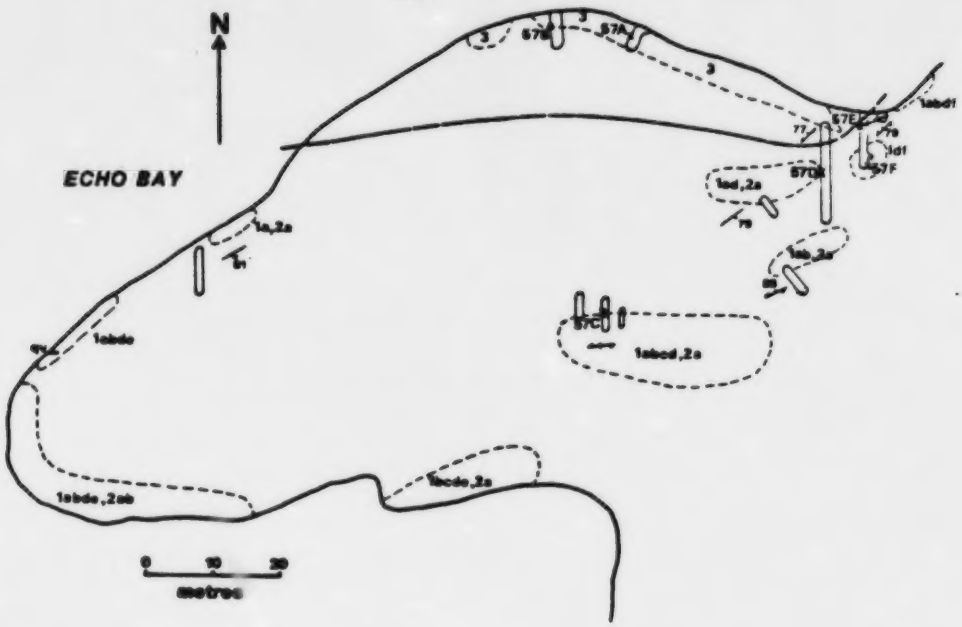




LEGEND

- trench
- quartz vein
- strike and dip of foliation
- inferred fault
- outcrop area
- A vein description and/or assay (see Table 7 for results)

Figure 16 : Inglis Lake Occurrence



LEGEND

3 Gabbro

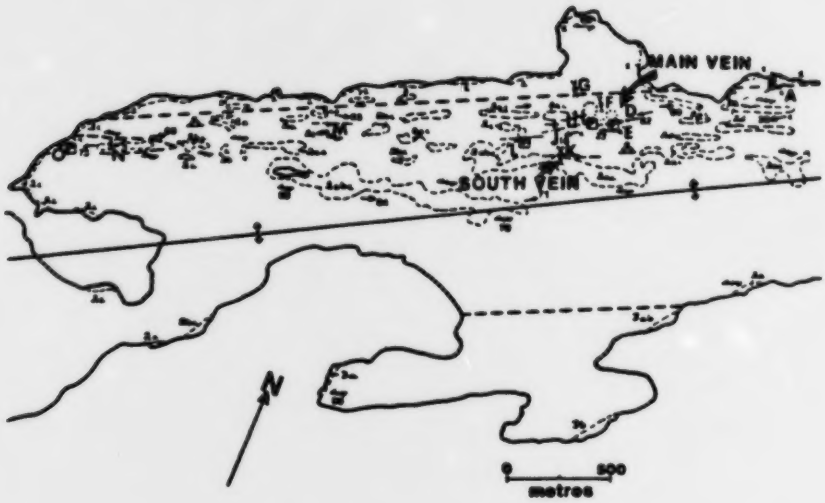
2 Interflow Sediments
- a mudstone and/or siltstone
- b wackes

1 Intermediate Fragmental Volcanics
- a tuff
- b lapilli tuff
- c tuff breccia
- d highly schistose
- e carbonitized
- f sericitized

SYMBOLS

- outcrop
- geological contact, inferred
- bedding, strike and dip (with tops)
- foliation, strike and dip
- 57A trench (with grab sample location) (for results see table 6, samples 57A to F)
- quartz vein
- silicified zone

Figure 17 : Noranda Exploration Company Limited (Gauthier Occurrence)



LEGEND

INTERMEDIATE tuff breccias

INTERMEDIATE VOLCANICS
- a Pillowed flow
- b Porphyritic flow
- c Amygdaloidal flow
- d Pillow breccia

MAFIC VOLCANICS
- a Amygdaloidal flow
- b Pillowed flow

QUARTZ FELSDPAR PORPHYRY INTRUSIVE

SYMBOLS

- shaft
- outcrop
- escarpment
- pillow tops
- geological contact
- muck pile
- anticlinal axis
- quartz vein
- trench
- foliation
- mineral lineation
- crenulation lineation
- A grab sample location

Figure 18 : G. Pogson Property (Three Friends Occurrence)

TABLES

Table 1: Table of Lithologic Units for the Clearwater Bay Area.

PHANEROZOIC

CENOZOIC

QUATERNARY

PLEISTOCENE AND RECENT

Glacial, glacial-fluvial, stream, lake, and swamp deposits

Unconformity

PRECAMBRIAN

PROTEROZOIC

APHEBIAN

Mafic Intrusive Rocks

Diabase

Intrusive Contact

ARCHEAN

Mafic Intrusive Rocks

Biotite Lamprophyre

Intrusive Contact

Syntectonic to Late Tectonic Felsic Intrusive Rocks

Tonalite, porphyric tonalite, quartz monzodiorite, felsite

Intrusive Contact

Pretectonic to Syntectonic Felsic to Intermediate Intrusive Rocks

Granodiorite and tonalite gneiss, megacrystic granodiorite, quartz monzodiorite, granodiorite, diorite

Intrusive Contact

White Partridge Bay Group

Metasedimentary Rocks

Feldspathic wacke, quartz wacke/tuff, mudstone, siltstone, conglomerate/tuff breccia

Unconformity

Metamorphosed Felsic to Intermediate Intrusive Rocks

Feldspar ± quartz ± amphibole porphyry, felsite

Intrusive Contact

Metamorphosed Mafic Intrusive Rocks

Melanogabbro, gabbro, leucogabbro, quartz gabbro, quartz diorite

Gradational Contact

Metamorphosed Ultramafic Intrusive Rocks

Peridotite and pyroxenite

Intrusive Contact

Metavolcanic and Metasedimentary Rocks

Metasediments

Feldspathic wacke, mudstone, siltstone, chert, sulphide ironstone, silicate-magnetite ironstone

Felsic Metavolcanics

Tuff, lapilli tuff, tuff breccia, pyroclastic breccia, quartz-feldspar crystal tuff

Intermediate Metavolcanics

Tuff, lapilli tuff, tuff breccia, pyroclastic breccia, plagioclase ± quartz crystal tuff,

pillowed flow, massive flow, amygdaloidal flow, flow breccia, pillow breccia, hyaloclastite

Mafic Metavolcanics

Massive flow, pillowed flow, amygdaloidal flow, variolitic flow, plagioclase porphyritic flow, flow breccia, pillow breccia, hyaloclastite, tuff/lapilli tuff/tuff breccia

Table 2: Estimated Modal Mineralogy of Metamorphosed Felsic to Intermediate Intrusions (Unit 9).

	Winnipeg River Subprovince		Winnetka Lake Stock				Ridge Lake Stock		Granite Lake Stock
Rock Type	Gneissic Granodiorite	Megacrystic Granodiorite	Hbn. Granodiorite	Hbn.-Quartz Monzodiorite	Hbn. Diorite	Hbn. Diorite	Bi.-Quartz Monzodiorite	Megacrystic Granodiorite	Megacrystic Granodiorite
Sample No.	103	112	438	468	414a	415	462	163	405
Plagioclase	45	50	55	55	55	55	65	45	50
(Composition)	An29	An23	An35-25		An24		An34-28	An28	An28
Quartz	25	20	10	10	5	3	10	30	25
Microcline	20	20	20	15	tr	2	10	20	20
Biotite	7	10	5	5	5		10	4	5
Amphibole			10	15	35	35		tr	
Muscovite	2	tr							
Chlorite						5			
Epidote	1	tr	tr	tr		tr	5	1	tr
Sphene			tr	1	tr	tr	tr		tr
Apatite		tr	tr	tr		tr	tr	tr	tr
Opaques			tr			tr	tr		

Table 3: Estimated Modal Mineralogy of Syntectonic to Late Tectonic Felsic Intrusive Rocks (Unit 10).

	Rush Bay Stock	Canoe Lake Stock	
Rock	Plag.-Kspar	Plag.-Qtz.	
Type	Porphyry	Porphyritic Tonalite	Tonalite
Sample No.	748	483	700
Plagioclase	55	70	65
Quartz	10	25	30
Microcline	22		
Biotite	8		3
Amphibole		5	2
Apatite	tr		tr
Titanite		tr	tr
Sericite	tr	tr	tr
Carbonate	tr	tr	
Opaque	tr	tr	tr
Minerals			
Chlorite		tr	tr
Epidote	tr	tr	tr

Table 4: Chemical Analysis of Samples from the Clearwater Bay Area.

MAJOR OXIDE LISTING

	86JAA-0020	86JAA-0027	86JAA-0037	86JAA-0038	86JAA-0075	86JAA-0142
SiO2	54.40	60.70	49.30	49.00	48.80	59.00
TiO2	1.23	0.64	1.25	2.36	0.67	0.65
Al2O3	16.90	16.20	16.00	14.60	15.80	16.10
Fe2O3	8.13	6.04	15.00	15.10	11.50	6.23
FeO	00.00	00.00	00.00	00.00	00.00	00.00
MnO	0.13	0.06	0.15	0.17	0.16	0.07
MgO	3.52	4.00	5.48	5.21	8.00	4.33
CaO	8.09	5.32	6.62	6.73	9.78	5.66
Na2O	4.26	3.00	1.00	2.57	00.00	3.30
K2O	0.14	1.15	00.00	0.07	00.00	1.93
P2O5	0.14	0.21	0.09	0.33	0.05	0.31
CO2	1.10	0.07	1.04	0.18	1.01	0.57
S	0.11	0.01	0.05	0.07	0.12	0.01
H2O+	00.00	00.00	00.00	00.00	00.00	00.00
H2O-	00.00	00.00	00.00	00.00	00.00	00.00
LOI	2.40	1.80	4.60	2.90	4.70	1.70
TOTAL	99.30	99.10	99.50	99.00	99.40	99.30

TRACE ELEMENT LISTING

	86JAA-0020	86JAA-0027	86JAA-0037	86JAA-0038	86JAA-0075	86JAA-0142
As	-2	-2	-2	-2	-2	-2
Co	34	22	45	44	49	23
Cr	104	148	229	114	391	149
Cu	66	24	95	80	117	50
Ni	39	66	130	64	145	67
Pb	-10	-10	-10	-10	-10	-10
Zn	80	55	122	148	74	69
Nb	5	-5	-5	12	-5	-5
Rb	7	29	-5	-5	-5	24
Sr	169	636	182	433	107	916
Y	25	16	27	43	22	17
Zr	130	182	92	203	64	186
Th	10	-10	-10	-10	10	19
Pr	4.3	7	1.8	6.1	830 B	9.3
Sm	3.5	4.2	2.5	5.9	1.5	6
Eu	1.1	1.2	940 B	1.9	540 B	1.6
Gd	3.9	3.1	3.4	6	2	4.2
Tb	600 B	410 B	530 B	960 B	370 B	490 B
Dy	3.6	2.2	3.7	5.8	2.4	2.5
Ho	690 B	380 B	740 B	1.2	530 B	420 B
Er	2.2	1.1	2.3	3.3	1.7	1.2
Tm	310 B	140 B	320 B	460 B	220 B	150 B
Yb	1.7	980 B	1.9	2.8	1.5	1
Lu	280 B	150 B	300 B	420 B	230 B	140 B
Au	20 B	-2 B	-2 B	-2 B	-2 B	-2 B
Pt	-1 B	-1 B	-1 B	-1 B	11 B	-1 B
Pd	-1 B	-1 B	-1 B	-1 B	14 B	-1 B
Ce	32	56	12	42	5.2	75
La	15	25	4.9	17	2	35
Nd	16	24	8.5	26	4.5	35
Y	15	8.7	15	24	11	9.2

MAJOR OXIDE LISTING

	86JAA-0168	86JAA-0172	86JAA-0310	86JAA-0331	86JAA-0335	86JAA-0349
SiO2	47.10	50.90	47.70	49.00	49.40	42.10
TiO2	0.50	2.48	3.65	1.38	1.23	0.30
Al2O3	17.80	15.00	11.60	15.00	15.00	5.35
Fe2O3	10.40	13.80	16.30	13.10	13.50	13.00
FeO	00.00	00.00	00.00	00.00	00.00	00.00
MnO	0.15	0.22	0.21	0.20	0.21	0.12
MgO	9.39	3.13	5.82	5.36	4.45	27.70
CaO	10.70	8.88	9.74	8.28	9.61	3.06
Na2O	1.42	3.49	1.90	2.35	1.23	00.00
K2O	0.17	0.24	0.14	0.92	0.11	0.01
P2O5	0.04	0.24	0.21	0.15	0.11	00.00
CO2	0.08	1.12	0.25	1.20	1.56	0.78
S	0.05	0.07	0.14	0.13	0.11	0.03
H2O+	00.00	00.00	00.00	00.00	00.00	00.00
H2O-	00.00	00.00	00.00	00.00	00.00	00.00
LOI	1.70	1.00	1.60	2.90	3.80	8.30
TOTAL	99.40	99.40	98.90	98.60	98.70	99.90

TRACE ELEMENT LISTING

	86JAA-0168	86JAA-0172	86JAA-0310	86JAA-0331	86JAA-0335	86JAA-0349
As	-2	-2	-2	-2	-2	-2
Co	49	56	36	41	41	90
Cr	369	122	-10	163	192	1410
Cu	93	67	24	96	79	22
Ni	184	74	-5	59	91	865
Pb	-10	-10	-10	15	-10	-10
Zn	73	120	108	102	130	42
Nb	-5	13	13	-5	-5	-5
Rb	5	-5	-5	25	-5	-5
Sr	103	337	170	321	248	18
Y	17	31	34	29	29	12
Zr	56	181	147	124	107	31
Th	-10	-10	-10	-10	-10	-10
Pr	690 B	4.5	4.3	3.9	2.7	320 B
Sm	1.1	5.4	4.6	4.1	3.2	460 B
Eu	480 B	1.8	1.5	1.4	1.1	130 B
Gd	1.6	5.6	5.1	4.3	3.6	710 B
Tb	310 B	910 B	800 B	700 B	630 B	130 B
Dy	2	4.9	4.6	4.3	4	930 B
Ho	450 B	1	930 B	880 B	830 B	210 B
Er	1.4	2.6	2.6	2.4	2.3	650 B
Tm	190 B	340 B	340 B	320 B	300 B	80 B
Yb	1.4	2.2	2	2.1	2.2	700 B
Lu	220 B	310 B	310 B	300 B	300 B	100 B
Au	-2 B	-2 B	-2 B	-2 B	-2 B	2 B
Pt	7 B	-1 B	-1 B	-1 B	-1 B	3 B
Pd	4 B	-1 B	-1 B	-1 B	-1 B	2 B
Ce	3.7	29	30	26	19	2.1
La	1.2	11	12	9.8	7.1	790 B
Nd	3.1	20	18	16	11	1.4
Y	9.4	19	19	17	17	3.9

MAJOR OXIDE LISTING

	B6JAA-0358	B6JAA-0359	B6JAA-0371	B6JAA-0377	B6JAA-0380	B6JAA-0405
SiO2	52.70	49.90	57.20	54.70	76.10	70.50
TiO2	0.56	0.60	0.71	1.29	0.10	0.11
Al2O3	14.00	13.30	15.60	17.20	12.70	16.20
Fe2O3	10.20	11.90	9.39	9.04	1.71	1.26
FeO	00.00	00.00	00.00	00.00	00.00	00.00
MnO	0.12	0.15	0.14	0.11	0.01	00.00
MgO	8.20	8.54	4.66	5.30	0.55	0.59
CaO	7.44	9.12	3.69	3.33	1.22	2.18
Na2O	3.28	2.97	3.00	3.80	2.80	5.02
K2O	0.06	0.03	2.94	1.53	4.97	2.64
P2O5	0.04	0.04	0.16	0.24	0.01	0.04
CO2	0.32	0.27	0.19	0.13	0.19	0.14
S	0.01	0.01	0.01	0.01	0.01	0.01
H2O+	00.00	00.00	00.00	00.00	00.00	00.00
H2O-	00.00	00.00	00.00	00.00	00.00	00.00
LOI	2.10	1.90	2.20	2.60	0.50	0.50
TOTAL	98.70	98.50	99.70	99.10	99.60	99.00

TRACE ELEMENT LISTING

	B6JAA-0358	B6JAA-0359	B6JAA-0371	B6JAA-0377	B6JAA-0380	B6JAA-0405
As	-2	-2	-2	-2	-2	-2
Co	37	44	26	30	-5	-5
Cr	395	390	187	113	-10	12
Cu	40	91	30	11	-5	5
Ni	68	75	91	70	-5	8
Pb	-10	595	22	22	32	32
Zn	46	64	109	96	17	32
Nb	-5	-5	6	10	20	-5
Rb	-5	-5	117	83	116	85
Sr	70	101	170	209	47	539
Y	17	19	30	29	59	5
Zr	56	63	152	190	124	122
Th	-10	-10	15	-10	20	-10
Pr	930 B	840 B	6.2	6.3	8.6	
Sm	1.3	1.3	4.8	5.1	9.4	
Eu	480 B	430 B	1.3	1.5	290 B	
Gd	1.8	1.7	4.4	4.5	10	
Tb	320 B	310 B	740 B	750 B	1.5	
Dy	2.3	2.1	4.7	4.2	9.5	
Ho	520 B	490 B	1.1	900 B	2	
Er	1.5	1.6	3	2.3	5.4	
Tm	210 B	220 B	440 B	320 B	810 B	
Yb	1.6	1.6	3	2.1	5	
Lu	250 B	240 B	450 B	290 B	760 B	
Au	-2 B	-2 B	2 B	-2 B	-2 B	-2 B
Pt	8 B	7 B	2 B	2 B	-1 B	-1 B
Pd	8 B	5 B	-1 B	-1 B	-1 B	-1 B
Ce	6.4	6.1	49	51	59	
La	2.9	2.7	22	22	23	
Nd	3.9	3.7	22	22	33	
Y	9.5	9.3	21	20	50	

MAJOR OXIDE LISTING

	B6JAA-0414	B6JAA-0415	B6JAA-0462	B6JAA-0468	B6JAA-0600	B6JAA-0609
SiO2	53.40	53.70	66.40	66.40	48.30	49.90
TiO2	0.38	0.92	0.36	0.66	1.86	0.53
Al2O3	17.00	17.30	17.00	15.70	14.50	18.30
Fe2O3	6.68	8.14	3.48	3.52	14.60	9.08
FeO	00.00	00.00	00.00	00.00	00.00	00.00
MnO	0.11	0.11	0.05	0.03	0.33	0.11
MgO	6.36	5.50	1.83	2.06	5.36	6.64
CaO	6.52	4.94	3.33	3.13	8.60	8.26
Na2O	3.74	4.30	3.91	3.26	2.91	2.45
K2O	1.73	1.89	2.44	2.87	0.34	1.00
P2O5	0.19	0.38	0.10	0.14	0.17	0.08
CO2	0.25	0.13	0.30	0.15	0.45	0.14
S	0.01	0.01	0.01	0.01	0.01	0.01
H2O+	00.00	00.00	00.00	00.00	00.00	00.00
H2O-	00.00	00.00	00.00	00.00	00.00	00.00
LOI	1.90	2.60	0.90	0.70	2.10	2.90
TOTAL	100.00	99.80	99.80	98.50	99.00	99.30

TRACE ELEMENT LISTING

	B6JAA-0414	B6JAA-0415	B6JAA-0462	B6JAA-0468	B6JAA-0600	B6JAA-0609
As	-2	-2	-2	-2	-2	-2
Co	28	25	8	10	35	34
Cr	274	211	39	68	99	125
Cu	34	28	30	14	88	8
Ni	100	69	14.	26	48	128
Pb	20	13	23	26	-10	-10
Zn	74	97	52	52	210	52
Nb	-5	6	-5	6	5	-5
Rb	70	92	82	98	12	24
Sr	538	472	434	450	209	377
Y	16	21	13	15	44	15
Zr	133	215	163	189	134	106
Th	14	18	11	15	-10	-10
Pr					2.9	2.5
Sm					4	2.2
Eu					1.4	830 B
Gd					5.1	2.2
Tb					890 B	340 B
Dy					5.8	2.1
Ho					1.3	440 B
Er					3.8	1.3
Tm					520 B	180 B
Yb					3.4	1.2
Lu					500 B	200 B
Au	-2 B	-2 B	-2 B	-2 B	-2 B	-2 B
Pt	3 B	4 B	1 B	-1 B	-1 B	-1 B
Pd	-1 B	25 B	-1 B	-1 B	-1 B	-1 B
Ce					17	17
La					6.8	8
Nd					14	9.8
Y					30	9.1

MAJOR OXIDE LISTING

	B6JAA-0627	B6JAA-0629	B6JAA-0630	B6JAA-0631	B6JAA-0632	B6JAA-0634
SiO2	74.40	58.50	56.60	75.90	74.80	79.10
TiO2	0.29	0.95	1.33	0.13	0.15	0.04
Al2O3	14.00	17.10	14.90	11.20	10.30	10.80
Fe2O3	1.89	8.31	12.00	1.03	1.73	0.88
FeO	00.00	00.00	00.00	00.00	00.00	00.00
MnO	0.01	0.13	0.16	00.00	0.03	00.00
MgO	0.02	4.00	6.24	0.87	1.04	0.26
CaO	0.52	2.29	1.49	1.27	2.19	0.60
Na2O	4.16	5.25	2.99	1.28	0.87	0.34
K2O	2.23	0.04	0.06	5.37	4.63	6.38
P2O5	0.01	0.18	0.07	00.00	00.00	0.01
CO2	0.44	0.22	0.19	2.12	3.55	0.91
S	0.14	0.01	0.01	0.01	0.01	0.01
H2O+	00.00	00.00	00.00	00.00	00.00	00.00
H2O-	00.00	00.00	00.00	00.00	00.00	00.00
LOI	1.40	2.40	3.50	2.20	3.70	0.90
TOTAL	98.90	99.10	99.30	99.20	99.40	99.30

TRACE ELEMENT LISTING

	B6JAA-0627	B6JAA-0629	B6JAA-0630	B6JAA-0631	B6JAA-0632	B6JAA-0634
As	-2	-2	-2	-2	-2	-2
Co	6	24	42	-5	-5	-5
Cr	-10	39	207	-10	-10	-10
Cu	12	31	62	32	7	7
Ni	-5	37	118	-5	-5	-5
Pb	-10	-10	-10	47	38	36
Zn	12	66	142	13	26	46
Nb	23	9	-5	12	11	25
Rb	50	-5	-5	75	89	157
Sr	55	122	29	41	41	54
Y	69	25	21	37	30	45
Zr	200	165	75	115	110	91
Th	16	10	-10	13	-10	24
Pr	9.8	5.4	1.3	9.8	6.2	4.2
Sm	8.4	4.2	2	8.2	5	6.6
Eu	1.1	1.3	510 B	520 B	430 B	110 B
Gd	7.6	3.9	2.6	6.8	4.2	7.4
Tb	1.1	560 B	490 B	1	690 B	1.3
Dy	7.5	3.5	3.1	5.5	4.2	7.7
Ho	1.6	690 B	690 B	1.1	820 B	1.6
Er	5	1.8	1.9	3	2.4	4.4
Ta	800 B	250 B	260 B	410 B	350 B	640 B
Yb	5.8	1.8	1.8	2.6	2.5	4.9
Lu	900 B	250 B	250 B	400 B	420 B	710 B
Au	-2 B	-2 B	-2 B	-2 B	5 B	5 B
Pt	-1 B	-1 B	-1 B	-1 B	25 B	2 B
Pd	-1 B	-1 B	-1 B	-1 B	16 B	1 B
Ce	76	42	8.3	75	51	27
La	33	19	2.8	33	22	10
Nd	36	20	6.2	37	22	17
Y	39	17	12	24	21	38

MAJOR OXIDE LISTING

	86JAA-0748	86JAA-0753	86JAA-0755	86JAA-0756
SiO2	63.20	58.30	60.30	49.00
TiO2	0.42	1.22	0.57	0.70
Al2O3	16.40	16.60	16.80	16.10
Fe2O3	3.80	7.55	7.10	12.70
FeO	00.00	00.00	00.00	00.00
MnO	0.03	0.11	0.08	0.20
MgO	1.64	3.18	3.44	7.12
CaO	2.60	3.99	5.67	11.30
Na2O	5.55	3.86	0.46	1.87
K2O	2.99	2.71	2.55	0.10
P2O5	0.21	0.69	0.09	0.04
CO2	1.85	0.44	0.13	0.57
S	0.02	0.25	0.02	0.02
H2O+	00.00	00.00	00.00	00.00
H2O-	00.00	00.00	00.00	00.00
LOI	2.50	1.60	2.90	0.90
TOTAL	99.30	99.80	99.90	100.00

TRACE ELEMENT LISTING

	86JAA-0748	86JAA-0753	86JAA-0755	86JAA-0756
As	-2	-2	-2	-2
Co	8	20	19	48
Cr	36	53	85	360
Cu	13	53	24	37
Ni	15	29	45	117
Pb	35	12	-10	48
Zn	69	68	81	100
Nb	7	11	-5	-5
Rb	111	58	97	-5
Sr	743	552	283	89
Y	16	24	13	21
Zr	204	248	172	64
Th	11	15	-10	-10
Pr		23	4.6	840 B
Sm		11	3.2	1.5
Eu		2.6	950 B	550 B
Gd		7.2	3	2.4
Tb		950 B	440 B	400 B
Dy		4.3	2.5	2.8
Ho		800 B	480 B	620 B
Er		2	1.3	1.9
Tm		280 B	170 B	290 B
Yb		1.7	1.1	1.8
Lu		260 B	180 B	290 B
Au	-2 B	-2 B	-2 B	-2 B
Pt	-1 B	-1 B	-1 B	9 B
Pd	-1 B	-1 B	-1 B	10 B
Ce		185	39	5.2
La		84	20	1.9
Nd		80	17	4.2
Y		19	11	13

Table 5: Description of Analyzed Samples from the Clearwater Bay Area.

Sample No.	Description
86JAA-0020	Pillowed intermediate flow
0027	Amphibole-plagioclase porphyry
0037	Massive mafic flow
0038	Massive mafic flow
0075	Massive mafic flow
0142	Intermediate massive flow or tuff
0168	Plagioclase porphyritic mafic sill or flow
0172	Pillowed mafic flow
0310	Magnetitic gabbro
0331	Pillowed mafic flow
0335	Massive mafic flow
0349	Peridotite
0358	Pillowed mafic flow
0359	Massive mafic flow
0371	Pillowed intermediate flow
0377	Pillowed intermediate flow
0380	Felsic lithic tuff
0405	Alkali feldspar megacrystic granodiorite
0414	Coarse-grained diorite
0415	Coarse-grained diorite
0462	Quartz monzodiorite
0468	Quartz monzodiorite
0600	Massive mafic flow

0609	Leucogabbro
0627	Felsite
0629	Intermediate massive flow
0630	Intermediate pillowed flow
0631	Quartz-feldspar crystal tuff
0632	Quartz-feldspar crystal tuff
0634	Felsic lithic tuff
0748	Plagioclase-alkali feldspar porphyry
0753	Intermediate amygduloidal flow
0755	Intermediate pillowed flow
0756	Pillowed mafic flow

Table 6: Grab sample assay values for samples collected during the 1986 field season. Sample numbers correspond to location numbers on map face. Gold, platinum and pallidium values in ppb or oz per ton (in brackets), others in ppm or percentage as indicated. Analyses by the Geoscience Laboratories, Ontario Geological Survey, Toronto.

Sample No.	Mineralization*	Au	Ag	Cu	Pb	Zn	Other
1	Aahj/20cm/100o	4	<2				
2	abh/2m/095o	<2	<2				
3	Bh/1m/086o	5	<2				
4	BAahj/2m	<2	<2				
5	BAahj/2m/095o	17	<2				
6	BAahj	235	2				
7	BAadhj/1.5m/073o	8	<2				
8	Bhj/75cm/065o	13	<2				
9	Aahj/30cm/085o	17	<2				
10	Bh/75cm/056o	13	<2				
11	Babhj	9	<2				
12	Bhj/10cm/030°	85	<2				
13	Aahj	17	<2				
14	Bh/1m/082	4	<2	16	<10	55	
15	Babh/4m/062°	5	<2				
16	Bhj/10cm/075o	12	<2				
17	Aahj/25cm/060o	75	<2				
18	Aahj/5cm/060o	2090	<2				
19	BAahl/2m/080o	3830	<2				As7.5%
20	BAacf/2m/048o	<2	<2				
21	Aahj/15cm/074o	8	<2				
22	Aahj/2m/065o	365	4				
23	Bbdhj	15	<2				
24	Bhj/15cm/075o	8	<2				
25	hk	145	<2				
26	hj	<2	<2	450			P+<1,Pd>1
27A	Aahjlmno/30cm	155	7	81	1490	730	As 1.16%
27B	Aaehl/1cm/060o	5	<2				As 1200
28	Aabhl/1m/045o	22	<2				As 3400
29A	Aabchl/1m/050o	825	<2				As 2.6%
29B	Ab/1m/050o	<2	<2				
30	Aa/2m/050o	<2	<2				
31A	Bahj/50cm/065o	3450	5				
31B	Aa/5cm/065o	260	<2				
32	Babh/1m/067o	<2	<2				
33	hj/10m	<2	<2				
34	Bbhj/10cm	8	<2				
35A	Babhjl/1m/060o	75	<2	590	72	360	As 370
35B	Babhl/1m/075o	9	<2	92	<10	77	As 4900
36	hk/25m	<2	<2	46	<10	100	
37	Babhl/1m/040o	<2	<2				
38	Bahj/2m/035o	6	<2				
39A	Aachj/10cm/078°	(0.60)	26				
39B	Dhj	1230	<2				
40	Bahj/2m/080o	390	<2				

6 cont

41	Aahkm/1cm/075o	5	<2	164			
42	hjk/15m/060o	27	<2				
43A	Bafhj/2m/085o	210	<2				
43B	Bef	2	<2				
44	Chj	4	3				
45	Bhj	<2	<2				
46	Bhj	<2	<2				
47A	Aa	5	<2				
47B	Dehj	<2	<2				
48	Bbehj/2m/088o	3	<2				
49	hj	2	<2				P+<1, pd<1
50	Bahj/2m/080o	17	<2				
51A	Aahj/20cm	7520	<2				
51B	Bahj	20	<2				
52	Chj	19	<2				
53	Bhj/2m/075o	65	<2				
54A	Aaehj/40cm/057o	415	<2	33		43	
54B	Aaehj/40cm/057o	295	<2	33		40	
55	Aachj/2m/065o	5	<2				
56A	Abhmn/5cm	125	24	1390	1.27%	5	
56B	Dbhj	10	<2				
56C	Aabhj	7	<2				
56D	Bhj	10	<2				
57A	Bahj	800	<2				
57B	hjp	11	<2				
57C	Bahj	8000	<2				
57D	Bhj	65	<2				
57E	Bahj	2190	<2				
57F	Baehj	8	<2				
58	Db	5	<2	12			
59	Aabhj/40cm/100o	<2	<2				
60	Behj/1m/080o	12	<2				
61	Bhj	<2	<2				
62	Bhj/076o	<2	<2	37			
63	Aac/1m/052o	<2	<2				
64	Cp	<2	<2				
65	Babh	<2	<2				
66A	Aab/1m	<2	<2				
66B	Bahj	4	<2				
67	Aahkm/2m	<2	<2	287			
68	hj	7	2				
69	Bbhj/50cm/045o	<2	<2				
70A	Aab/2m/120o	<2	<2				
70B	Bhj	<2	<2				
71	Aab/3cm/065o	<2	<2				
72	Aabhj/2m	<2	<2				
73A	Aahj1/20cm/040o	120	<2				As 3.5%
73B	Aa/5cm/070o	<2	<2				As 62
74	Aab/10cm/065o	<2	<2				
75	Aahj1n/30cm/050o	115	<2				As 10.8%
76A	Cahj/20m	26	<2				
76B	Aahl/5mm	5	<2				As 1200
77	Bbehj/1m/077o	3	<2				
78A	Bahj/10m/078o	9	<2	280	16	1430	

Table 6 cont.

78B	Bafhj/10m/078o	18	<2	123	18	286	
78C	Aahj	5	<2				
79	Bh/30m/080o	<2	<2				
80	Aabf/5cm/070o	<2	<2				
81	hjk	<2	<2				P+6,Pd7
82	Bbef/3m	3	<2				
83	Babhj/5m	13	<2				
84	Bhij/50cm/075o	<2	<2				
85	Bij/30cm/090o	15	<2				
86	Bghj/50cm/090o	21	<2				
87	Bbhk/10m	18	<2				
88	Eabhj/10m	9	<2				
89	Bhj	2	<2				
90	Aah	2	<2				
91	Aahj/15cm	<2	<2				
92	Aabchj/20cm/076o	<2	<2				
93	Aabh/25cm/063o	6	<2	<5			Mo<10
94	bhj	80	<2	12			Mo<10
95	hj	6	<2	6			Mo<10
96	hj	24	<2	26			Mo<10
97	hjm	17	<2	465			Mo 30
98	hjm	<2	<2	97			Mo<10
99	Bhjm	70	10	590			Mo<10
100	hjm	9	3	363			Mo<10,P<1, Pd<1
101	Babhj/4m	19	<2	5			
102	hjm	4	<2	805			
103	Behj	<2	<2				
104	hj	2	<2				
105A	hjp	<2	<2				
105B	Bhjm/50cm/093o	7	<2	224			
106A	BAahj/30m	15	<2				
106B	BAahj/30m	22	13				
106C	BAahj/30m	3	<2				
107	ae	<2	<2				
108	Aahm/20cm/125o	940	95	1.62%			
109	Bhj	4	4				
110	Aabhj/30cm/128o	910	2	38			
111	Aabf/5cm	22	<2				
112A	Aabhj/30cm/076o	110	<2				
112B	Db	7	<2				
112C	Dabhj	4	<2				
113	Aabc/2m/120o	6	<2				
114A	Aachjm/35cm/105o	(0.31)	3	905			
114B	Dbc	23	<2	50			
114C	Aac/15cm/105o	150	<2	21			
114D	Aachjm/50cm/109o	3700	<2	470			
115	hjkp	8	<2				P+<1,Pd<1
116A	hjm/5m	25	<2	288			
116B	Aa/5cm	260	<2				
117	hkm	115	7	1950			
118	hj/3m/055o	1560	<2				
119	hj	60	<2				

Table 6 cont

120	Aabh/10cm/110o	<2	<2	
121	hj	7	<2	
122A	hk	8	<2	
122B	hj	100	<2	
123	Bhj/5m/105o	16	<2	
124	Babe/3m/090o	<2	<2	
125	Eabhj	540	<2	
126	Eabhj	1235	<2	
127A	Eabhj	850	<2	
127B	Eabhj	360	<2	
128	Bhj/10m/135o	60	<2	
129	Caghj/095	<2	<2	
130	ahjk	3	<2	
131	Bbhij	250	<2	
132	Bhj	<2	<2	36
133	Aabh/35cm/115o	<2	<2	

* Mineralization Code / Width of Vein or Zone / Strike of Vein or Zone

A	Vein	g	graphite
B	High strain Zone	h	disseminated sulphides
C	Chemical Sediment	i	massive sulphides
D	Wallrock	j	pyrite
E	Breccia Zone	k	pyrrhotite
a	quartz	l	arsenopyrite
b	carbonate	m	copper sulphides &/or oxides
c	tourmaline	n	galena
d	chlorite	o	sphalerite
e	sericite	p	magnetite
f	green mica		

1 location of assay sample

Table 7: Grab Sample Assays: Inglis Lake Occurrence: (see Figure 17 for sample locations).

Trench Sample	Vein Width (cm)	Strike/Dip	Sample Description	Au ppb (oz/t)	Ag ppm
A	2-12		none taken		
B	10		none taken		
C-1	45-65		Qv with 5% py	700	<2
C-2			wallrock with 5% diss py 5 cm from vein	490	<2
D-1	55	073o/84oS	Qv with 1% py	1250	<2
E-1	15		Qv with 2% py	6100	8
E-2			Wallrock with 1% py 7.5 cm from vein	880	<2
F-1	10	073o/90o	Qv with tr. py. & tour	(0.60)	26
F-2			Highly schistose wallrock with tr. py	1230	<2
G-1	5-10	071o/86oS	Qv with 1-2% py	4000	5
G-2			Highly schistose wallrock with tr. py	580	<2
H-1	10	079°/88°S	Qr with 5% py & tr. tour.	(0.50)	22
I-1	12-18	074°/86°S	Qv with tour & 2% py	1540	2
I-2			Highly schistose wallrock	440	<2
J-1	38-68		Qv with 1-2% py	2880	5
J-2			Wallrock with 5% diss. py	1360	2
K-1	30-32	075o/82S	Qv with 1% py	3790	34
K-2			Wallrock with 3-4% diss. py	440	2
L-1	30-42	069/86S	Qv with 5% py	4790	4
L-2			Wallrock with 5% diss. py. 12 cm from vein	475	<2

Table 8: Grab Sample Assays - G. Pogson Property (Three Friends Occurrence):
(See Figure 18 for Sample locations)

Sample	Au (ppb)	Ag (ppm)	As (ppm)	Grab Sample Description
A	305	<2	1.4%	sheared metavolcanic with py, & asp.
B	12	<2	5000	Qv with tour., py and asp
C	<2	<2		Qv with 2% py
D	<2	<2		Qv
E	<2	<2		Qv with tour
F	<2	<2		Sheared metavolcanic
G	<2	<2		" "
H	15	<2		Qv
I	<2	<2		Qv
J	<2	<2		Qv
K	<2	<2		Qv
L	3	<2	9500	Qv with py & asp
M	<2	<2		sheared metavolcanic with fuch & py
N	<2	<2		Qv with 2% py
O	2090	<2		Qv with 5% py
P	3830	<2	7.5%	sheared metavolcanic with asp., py and qz veinlets

PHOTOGRAPHS

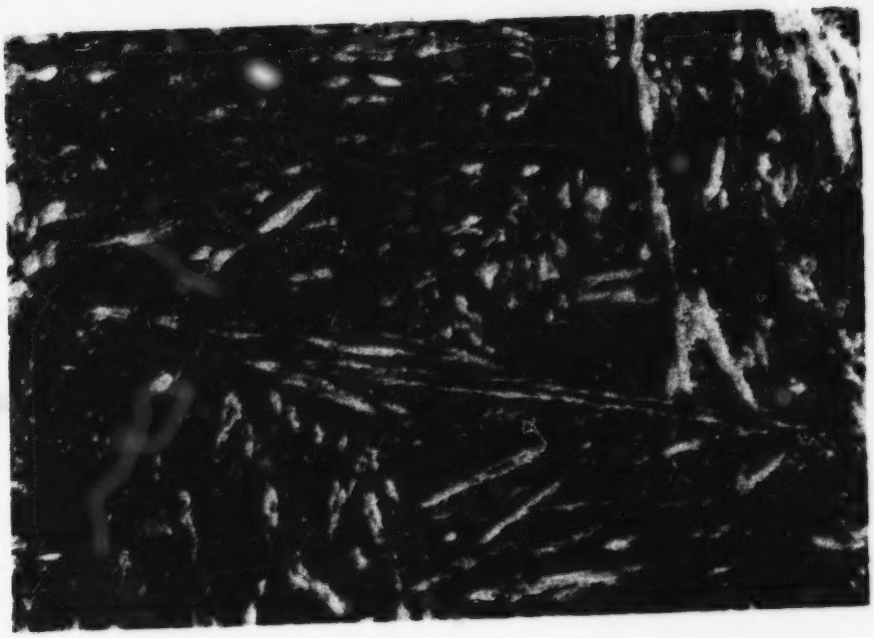


Photo 1: Photomicrograph of quench-textured Lower Mafic Unit Basalt. Acicular amphibolitized mafic phenocrysts with cores and swallow-tailed terminations of groundmass material. Groundmass consists of fine-grained plumose intergrowth of amphibole and plagioclase. Crossed polarizers, field of view 6.25 mm. Sample 86 JAA 0359 - south shore of Ash Bay.

Photo 2: Thinly banded intermediate flow from the east side of Ogema Bay.

Photo 3: Intermediate flow with irregular pillow (?) overlain by amygdaloidal flow with very large quartz-filled amygdules in subparallel alignment. Outcrop on the east side of Ogema Bay. Hammer handle is 40 cm long.

Photo 4: Intermediate pillow breccia northeast side of Ash Bay. Large pillow and fragments are bleached and the matrix is chloritized. Facing direction is to the left as indicated by the pillow with the scale hammer. Hammer handle is 40 cm long.

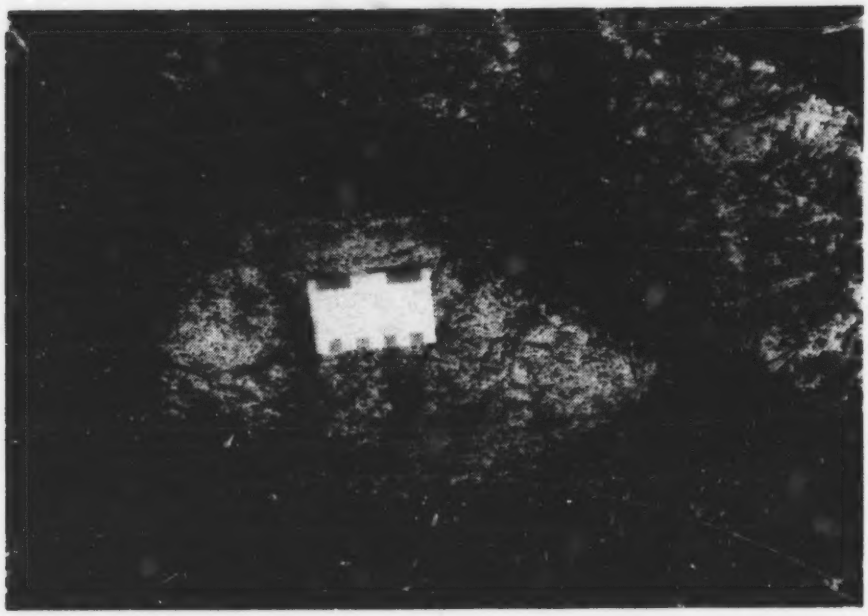


Photo 5: Close-up a fragment from Photo 4 shows an alteration rind which developed on one side of the pillow fragment (lower side) prior to brecciation.

Photo 6: Intermediate debris flow with angular to subrounded heterolithic fragments. Outcrop northeast of Ash Bay.

Photo 7: Intermediate debris flows; interbedded lapilli tuffs (right side), tuff breccias (centre), and thinly bedded tuffs (left side). Outcrop on Highway 17 just south of Hinterland Lake.

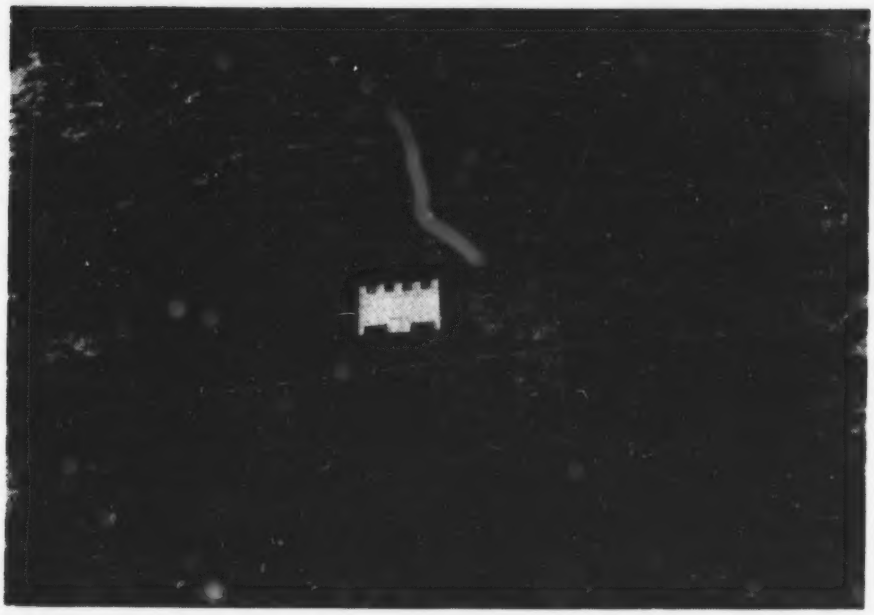


Photo 8: Massive felsic volcanic (flow, tuff or sill) with polygonal columnar joints. Outcrop on the south shore of Victoria Island.

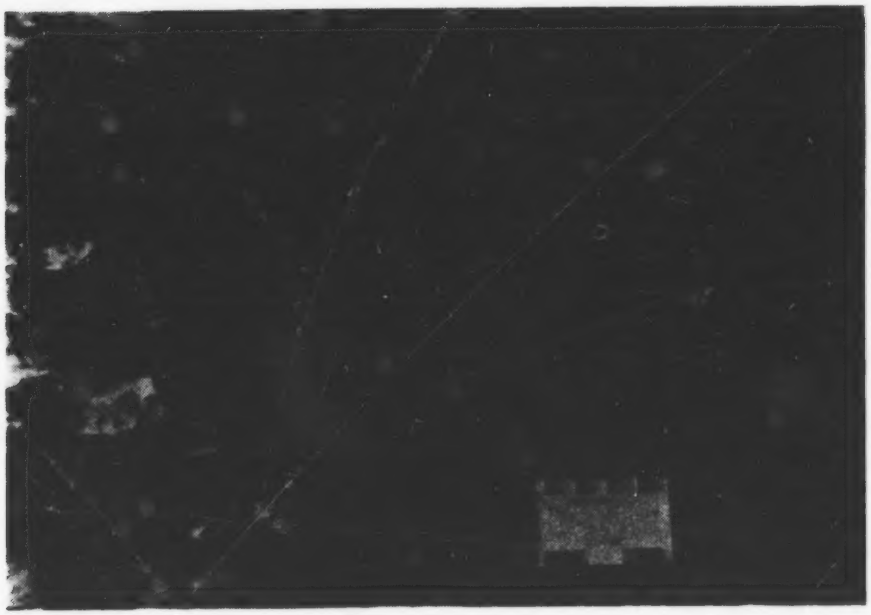


Photo 9: Felsic ignimbrite with interbedded tuff (grey) and very fine-grained cherty beds (black). Note the flame structures on one side of the cherty beds indicating facing direction is towards the top of the photo. Outcrop on the east side of Zigzag island.

Photo 10: Photomicrograph of felsic tuff breccia with partially welded pumice (Pu), lithic clasts (L) and quartz crystals (Q). Note the euhedral outlines of phenocrysts (Ph) in fragments and the angular broken outlines of crystals in the matrix (Q). Crossed polarizers, field of veiw 10 mm. Sample 86 JAA 0633 from the east side of Zigzag Island.

Photo 11: Thinly to thickly bedded siltstones and feldspathic wackes cut by a mafic dike. Small island in eastern Ptarmigan Bay.

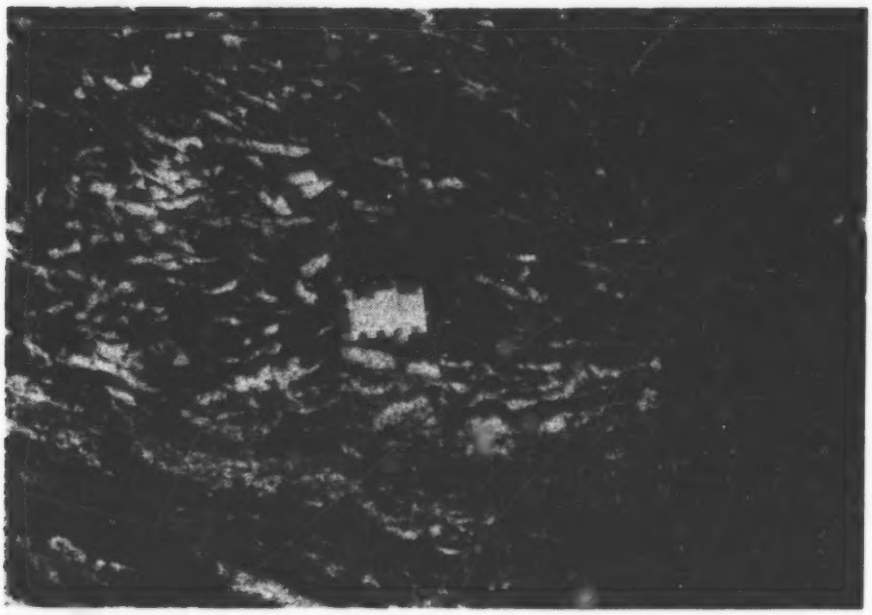


Photo 12: Ironstone with interbedded chert and argillite and highly distruped chert beds. East side of the small island 1 km northwest of Victoria Island.

Photo 13: Interbedded turbiditic conglomerates and thinly to thickly bedded wackes. Normal grading and flame structures indicate facing direction is towards the top of the photograph. Outcrop on the north side of Corkscrew Island.

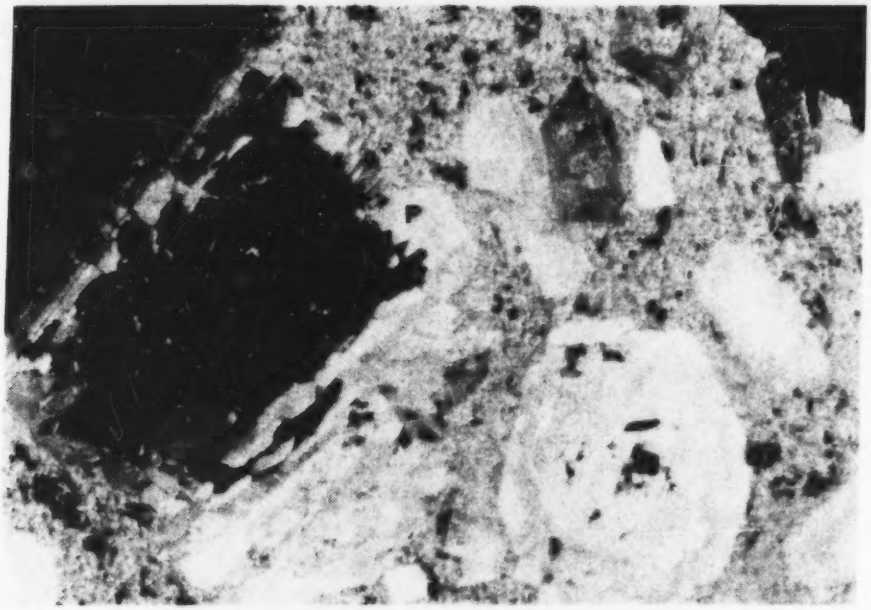


Photo 14: Photomicrograph of Rapikivi-textured porphyritic quartz monzodiorite from the Rush Bay Stock. Note the alkali feldspar phenocrysts core (A) mantled by fine-grained plagioclase phenocrysts (P). Crossed polarizers, field of view 10 mm. Sample 86 JAA 0748 from Rush Bay.

Photo 15: Lamprophyre dike containing rounded granitic and mafic inclusions cutting deformed pillowed metavolcanics (left side of photo). Outcrop on the northwest side of a small island 1 km east of Victoria Island. Hammer handle is 40 cm long.

3268
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MAPS
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